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EDITORIAL

THE GOLD TREATMENT OF TUBERCULOSIS

IT is as yet probably too early to give an appraisal of the work done in Copenhagen by Mollgaard on the treatment of tuberculosis with gold.

Authoritative literature on the subject has only recently become available, and has not had sufficient study to warrant any extensive criticism. But in view of the prominence being given the work at the present time, a brief discussion may prove profitable.

The gold preparation used by Mollgaard is sodium aurothiosulphate, which is said to have the formula $Au(S_2O_3)Na_3$. It is not a new compound, having been described first over seventy-five years ago, but Mollgaard claims to have introduced an improved method of preparation which renders it less toxic. The name "Sanocrysin" has been given the product as prepared by the new method.

Sanocrysin is said to prevent the growth of bovine tubercle bacilli in culture. If the drug in proper concentration be injected into calves infected with bovine tubercle bacilli, a marked reaction occurs, including oedema of the lungs, nephrosis, toxic myocarditis, and a pronounced fall in temperature. This reaction Mollgaard calls "tuberculin shock", and attributes to the liberation of endotoxins from destroyed bacilli. He claims that this "tuberculin shock" can be avoided by giving with the sanocrysin proper doses of serum from calves previously immunized wtih dead tubercle bacilli. Consequently, sanocrysin is always given in conjunction with the serum. It is claimed by some that this so-called "tuberculin shock" is not due to liberated endotoxins, but to the toxic effect of the drug itself, and the statement is made that many other gold salts will produce a similar reaction when injected. However this may be, the serum given with the drug appears to protect against these unfavourable results, at least to a certain extent, although most commentators state that even at best sanocrysin is a dangerous drug. Several deaths from its use have been reported by Danish clinicians who were working with human cases.

Experimentally, the treatment seems, from the reports given, to aid animals in the recovery from artificially produced bovine tuberculosis. No work has been done on animals infected with human bacilli. Reports have been published concerning two monkeys, diagnosed as tuberculous, who recovered under the sanocrysin treatment. On the whole, however, animal experimentation has been rather scanty as yet.

Clinically, reports of the results of this treatment are meagre indeed, but workers in Denmark frankly admit that it is distinctly limited in its effects. It appears that it is of little value in miliary tuberculosis, or in tuberculous meningitis, while advanced cases of pulmonary tuberculosis have only slight chances of recovery under the new treatment.

Mollgaard's experiments have been criticized as having been insufficiently controlled. Tuberculosis authorities in general seem to be unwilling to go further than to say that Mollgaard has done very interesting, and possibly very important work, for the final significance of which we must wait. Further experimentation, both on animals and in the clinic, more accurate standardization of the doses used, and confirmation of the work of the Danish men must come before sanocrysin can be seriously considered as more important than the usual "annual tuberculosis cure".

THE COURSE WE HAVE HAD

AN undergraduate hesitates to criticize the course of instruction given to him, because he knows it must be the result of a great deal of careful thought on the part of the teaching staff, whose purposes he may not fully realize. But looking back over six years, certain apparent deficiencies do strike one, and the opinion of a student in the graduating year, who has just been through the mill, and who is now able to get a view of the course as a whole, must have some value.

As undergraduates with no experience elsewhere, it is impossible for us to say from personal experience that we are better or worse taught here than others are elsewhere, but abundant external evidence convinces us that there can be few other places on this continent where a better education is given in the general medical sciences. The esteem which the modest M.B. (Tor.) seems to arouse in other places, is part of this evidence. So is the ease with which Toronto men can get positions on the other side of the line, and so is their frequent success in foreign countries. Though we can have no standard by which to judge our training here from our personal experience, we know that it has been good. We are all aware of the efforts being put forward on our behalf and we gratefully admire the very clever teaching that has in the main been our lot. We know in short that the course we have had has been a splendid one.

There are, however, four directions in which students here would appreciate a change in instruction. We would like to have treatment more strongly emphasized, surgery made more practical, more time for reading given to the two final years in the course, and a slightly more "vertical" division of the time-table, in order to add interest to the three junior years which become sometimes very tiresome indeed.

The problem of achieving these ends is no easy one, and one not likely to be settled by any suggestion an undergraduate could make. The frequent changes that have been made in the course in the past few years, sometimes in one of the directions here suggested, show that the Faculty are eager to make the Medical School at Toronto second to none,

and we may safely leave it to them to make improvements in the course whenever opportunity offers. The sixth year has an amused feeling that it has been the "laboratory material" for more than one successful experiment in medical education.

The past twenty-five years have seen wonderful advances in medical education. One wonders what will happen in the next twenty-five, and whether the dear public, our reluctant and unappreciative patrons, will ever be made to realize the complexity of this process of "going through for a doctor."

BUILD BROAD BEFORE YOU BUILD HIGH

IT is necessary for everyone to have a hobby if he is to amount to anything. While studying medicine, do not let other things be neglected, for perhaps less than 50% of education comes out of books. Be sure you get this 50%, then insist on getting the rest of it, even if it is quite elsewhere. The doctor who is not at the same time a liberally cultured gentleman; the surgeon who knows only scalpels and sutures; the paediatrician who is interested only in the number of calories per ounce, these are the slender hot-house plants of the profession, the flash in the pan, and not the great figures that carry medicine from age to age.

Great things are always done by the versatile man, the busy man; the man who works because he loves it—and not because he is driven; the man who travels easily and not he who pants under the load. Sir Auckland Geddes is equally famous as a medical doctor, a university professor, a soldier, a gentleman, and an international diplomat. Walter Leaf, who visited us some time ago and whose name is in the book at Hart House, is the head of the largest bank in the world, one of the four men who handled Britain's finances during the war. He is also one of the world's authorities on Economics, his books being freely used in this department in the University,—as well as the greatest Homeric scholar living, and one of the foremost Archeologists at present excavating in Asia Minor.

The man who stands beside his failure and whines, "I did the best I could", is a pitiable creature, but deserves no sympathy, for none of us are working at capacity. Do not be content with a single track mind. Show some interest in the world, and while you are building a broader foundation you will be surprised how the superstructure has advanced.

MENSTRUATION

We are presenting this month two articles on the much discussed subject of the physiology of menstruation. These articles, by Drs. Marlow and Low, represent two current views, the one sponsored by Dr. Marlow himself, and the other widely known as Fraenkel's. We commend the two articles as being both interesting and instructive for the student who is arriving at his own conclusions.

THE UNIVERSITY OF TORONTO

HAEMORRHAGIC DISEASE OF THE NEW BORN

D. V. Clark and A. D. Kelly, '25

In attempting to make a study of Haemorrhagic Disease of the New Born, we found it necessary, owing to great variation in methods and results, to establish figures for bleeding and clotting time which may be considered normal. Consequently we studied sixty-seven cases of apparently normal infants at the Burnside Obstetrical Hospital, and one hundred and twelve admitted to the Hospital for Sick Children for various conditions other than Haemorrhagic Diseases.

The methods employed to obtain these normal figures are the clinical ones in use at the Hospital for Sick Children. The determination of the bleeding time is estimated by the method described by Duke[1]. The child's heel is cleansed with 95% alcohol and allowed to dry. A sharp piece of glass is obtained by breaking a microscopic slide and the heel is punctured so that the blood flows, drop by drop. The blood is taken up on absorbent paper (laboratory filter paper or blotting paper may be used) at intervals of 30 sec. The bleeding time is the period from the moment of puncturing the skin until no stain of blood appears on the absorbent paper.

The clotting time is estimated by a practical modification of Wright's technique. Capillary tubes are made by drawing out glass tubing of 5 mm. bore over a Bunsen flame, making a capillary tube 8 inches in length. The tubes are drawn out the same distance, thus making the capillary bore approximately identical in all cases. One end of the capillary tube is touched to the drop of blood at the site of puncture and the blood is allowed to run up a distance of about three inches. This tube is set aside for three minutes and at intervals of 30 seconds a short piece is broken off the end until a thread of fibrin is noted between the broken portions. The time between the filling of the tube and the first appearance of the fibrin is the clotting time.

Rodda's[2] method of estimating clotting time was also used. It briefly consists of collecting a drop of blood in a clean watch glass containing a No. 6. lead shot. This is placed in a covered Petrie dish, or covered by a second watch glass, and gently tilted every 30 seconds until the shot is caught up in fibrin and no longer rolls. Coagulation is considered complete when this has occurred. In all our determinations the three methods were carried out coincidently from the same puncture, but for actual practice we recommend Rodda's method as more convenient for determining the clotting time.

Sixty-seven cases of normal infants varying in age from birth to four weeks, and averaging 6.5 days, were studied at the Burnside Hospital. The average bleeding time was 5.6 minutes with a normal variation between 3 and 7 minutes, while the clotting time by the Pipette method was 5.83 minutes, and by the watch glass and shot method 5.68 minutes. The analysis of these figures showed a variation from day to day during the first week of life.

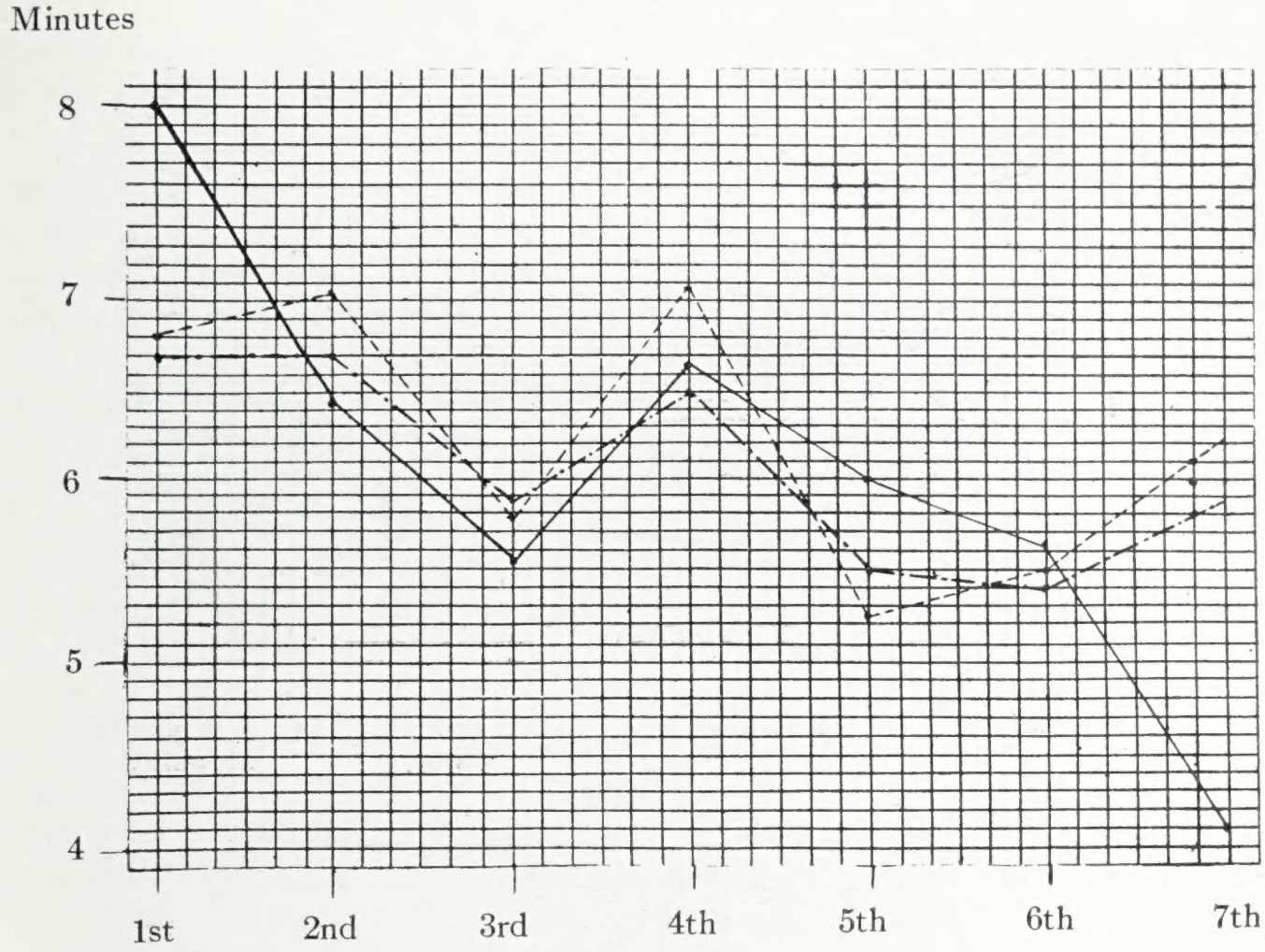

Figure I.—Daily variation in bleeding and clotting times for the first week of life.

It will be seen in Figure I that the bleeding time averages eight minutes on the first day, gradually falling to below six minutes on the third day, followed by a sudden rise to 6.6 minutes on the fourth day. There was a gradual subsequent lowering of bleeding time, falling sharply on the seventh day to four minutes. The clotting time by both methods was 6.7 minutes on the first day, thereafter roughly paralleling the bleeding time.

In the age group from one to eighteen months, with an average age of six and a half months, eighty-five cases were investigated, and it was found that the average bleeding time was 4.1 minutes, and the clotting time 4.8 and 4.3 minutes by the respective methods. The normal variation in bleeding time was between 2.5 and 6.5 minutes, and clotting time between 3 and 6 minutes, as over 80% of the series fell within these limits.

A consideration of the above two series of cases shows that bleeding and clotting time is highest in the first week of life. During the second week they are considerably lower, having fallen sharply as shown in Figure II. Subsequently a very gradual diminution occurs to the level of the older children.

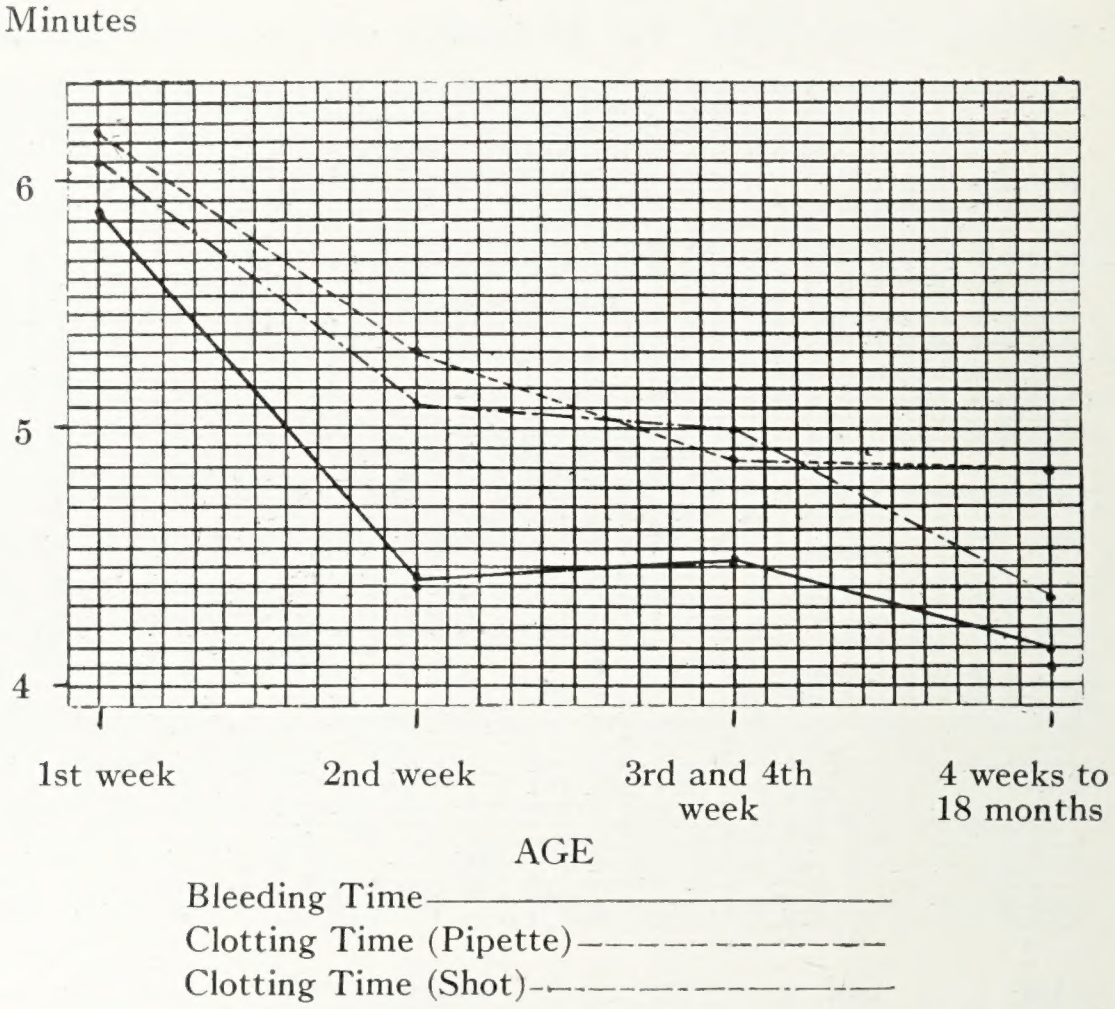

Figure II.—Variation in bleeding and clotting time from birth to eighteen months.

To determine if prematurity had any influence on the coagulability of the blood, twenty-seven infants born before full term were investigated. The results were as follows:—

Average bleeding time 6 minutes.

Average clotting time (pipette) 5.7 minutes.

Average clotting time (watch glass and shot) 5.4 minutes.

It will be seen from the above that the bleeding and clotting time of prematures falls well within the limits of normal full term infants.

During the course of our investigations the following conditions were encountered, in which the bleeding and clotting time was found to be definitely prolonged.

1. Haemorrhagic Purpura.
2. Primary Anaemia.
3. Congenital Syphilis.
4. Haemophilia.
5. Haemolytic Icterus.
6. One case of a female bleeder.
7. Haemorrhagic Disease of the New Born.

Haemorrhagic Disease of the New Born may be defined as a tendency to spontaneous and prolonged haemorrhage, occurring in infants during the first few days after birth. Sixty-seven infants suffering from this condition were admitted to the Hospital for Sick Chlidren during the

past three years, (1922 to 1924). We present the following study based on the analysis of their case histories.

It is the common belief that a raised bleeding and clotting time is essential to true haemorrhagic disease. However, we agree with von Reuss[3] from our findings, that cases of generalized bleeding in the new born must be divided into two groups; A. Those in which the bleeding and clotting time is prolonged; B. Those in which the bleeding and clotting time falls within the normal limits. We base this assertion on twenty-five cases in which the bleeding and clotting time was done. Fourteen of these cases fell into class A, the average bleeding time being 16.7 minutes and the average clotting time 15.9 and 20 minutes by the Wright's and Rodda's methods respectively. On the other hand eleven cases had an average bleeding time of 3.7 minutes, and clotting times of 4.5 and 4.7 minutes, falling into class B. In no other way did these cases differ clinically.

The factor of sex may have some influence on the condition as 59.7% of the series were males and 40.3% were females. Heredity appears to play no part, as in all cases the family history of haemorrhage proved negative. Apparently syphilis is not involved in this condition, as in no case was a positive Wassermann reaction found. The average age of onset was 52 hours. One case occurred on the ninth day, but the vast majority showed symptoms under 4 days. This, as was previously stated, is the period at which the bleeding and clotting time is normally at its maximum.

Some of the infants were admitted in fairly good condition but many were exsanguinated and some in moribund state, this depending on the severity and the duration of the disease. The symptoms mainly complained of were as follows: bleeding from visible parts, bloody or tarry

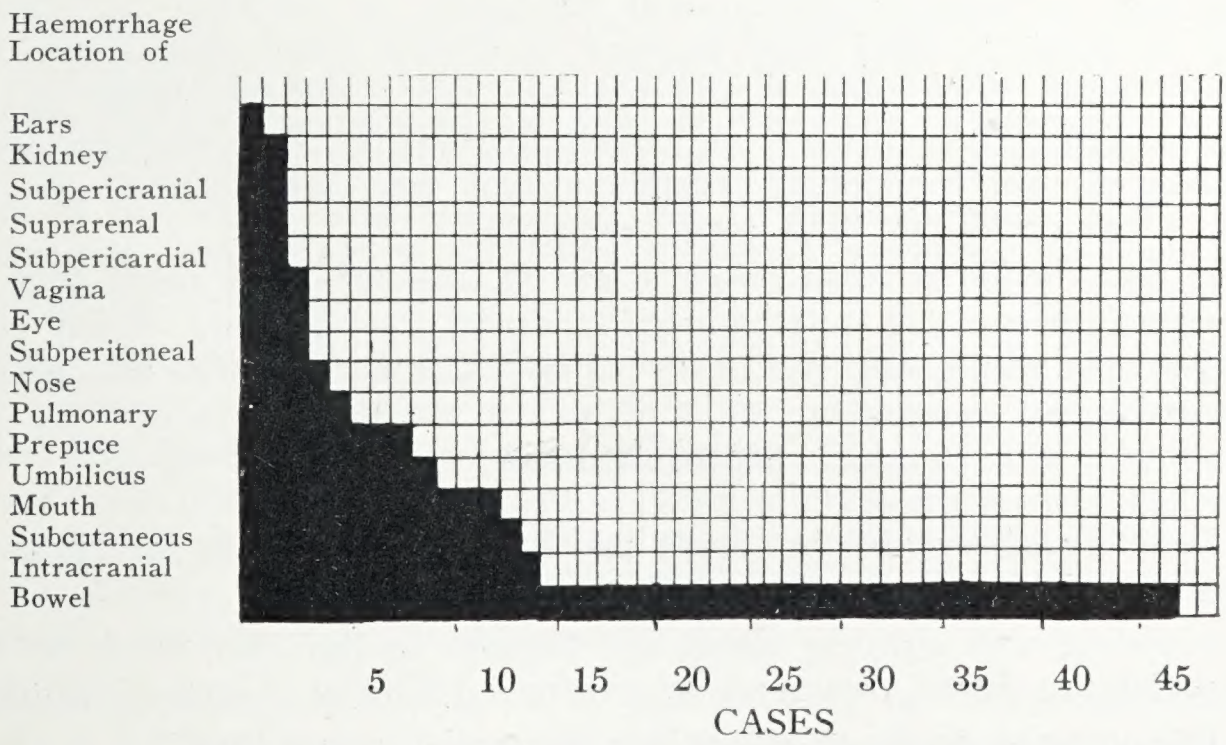

Figure III.—Relative frequency of organs involved in 67 cases of Haemorrhagic Disease of the New Born.

stools, haematemesis, pallor, cyanosis, dyspnoea, or convulsions. Subsequent examination showed the haemorrhage to have its origin in various organs, the frequency of their involvement being shown in Figure III.

It will be noted that bleeding from the bowel is by far the most common sign. In most cases bleeding was found to have more than one source. The examination of the blood showed a secondary anaemia which was very severe in some cases.

The best method of treatment for this condition is direct transfusion by the syringe and cannula method. This is used exclusively at the Sick Children's Hospital, and consists of the injection of 15 c.c. of non-citrated blood per pound of body weight into the internal saphenous vein at the ankle. In all cases the blood of the recipient is grouped by the Jansky method and it is essential that a donor of the same group be used to obviate incompatibility. With this precaution no reaction after transfusion occurred in any case. Ninety c.c. was the average amount of blood used in this series.

After transfusion, in all but two cases, the bleeding stopped either immediately or within one day. The general appearance and condition of the children was greatly improved and the blood examination showed the bleeding and clotting time to be lowered in all cases and the red blood cell counts to approach normal. The length of stay in the hospital with few exceptions was remarkably short, most cases being discharged on the day of admission. Many of these cases were subsequently investigated and no recurrence of haemorrhage was found.

The general mortality of the entire series was 34.3%. Of 12 cases not transfused for various reasons, 11 died, giving a mortality of 91.7%. Two cases were treated by the intraperitoneal injection of citrated blood. In neither case did the bleeding stop and both terminated fatally. The remaining 53 cases were treated by blood transfusion as described above, of these 10 died, giving a mortality of 18.8%, which obviously is a marked improvement on the general mortality of 34.3%. A careful analysis of these 10 fatal cases showed, in almost every case, some complicating factor; four were found to have had a difficult birth and intracranial haemorrhage; two were weakly prematures; two were moribund on admission; one developed erysipelas and one was found on post mortem examination to have intussusception.

It is quite evident from observation of this series of cases that the most efficacious method of treatment is direct transfusion. Many cases that otherwise would die, can be saved by early recognition, and prompt treatment by this means.

CONCLUSIONS

1. Duke's and Rodda's methods are best suited for the practical determination of bleeding and clotting times.

2. Bleeding and clotting times are highest in the first week of life. For practical purposes, they may be considered normal if under 7 minutes.

3. Prematurity does not affect bleeding and clotting time.

4. Haemorrhagic Disease of the New Born may be divided into two classes; A. Those in which the bleeding and clotting time is raised; B. Those in which the bleeding time falls within normal limits.

5. Bleeding in the first four days of life should be considered Haemorrhagic Disease of the New Born and treated promptly.

6. Bowel is most frequent site of haemorrhage in Haemorrhagic Disease of the New Born.

7. Haemorrhagic Disease of the New Born is not due to syphilis.

8. Direct transfusion is the only reliable treatment.

REFERENCES

[1]Duke, W. W., J.A.M.A., Oct. 1st, 1910.
[2]Rodda, Am. Jour. Dis. Children, April, 1920.
[3]von Reuss, A. R., Diseases of the New Born, page 459.

MENSTRUATION

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The term "Menstruation" immediately suggests the monthly periodical flow of blood which ordinarily occurs in the normal female between the ages of puberty and the menopause. This, however, is probably the least important manifestation of the changes occurring throughout the menstrual cycle, as it merely indicates that normal physiological processes are in action, and is incidental to these processes. Each individual is a law unto herself and normally manifests a regular periodicity and flow which varies little in amount.

The purpose of the menstrual cycle is to maintain the uterine mucosa in a healthy, fertile state and the process by which this is accomplished may be regarded as one of periodical irrigation. There is a monthly flushing and owing to a loss of balance between supply and return a break in the endometrial portion of the irrigation system occurs with a consequent unloading of the over congested area by the process of bleeding.

The anatomical arrangement of the vessels is admirably adapted to an irrigation system which is complete and efficient. The firm, elastic walled and finely distributed arteries course towards the endometrium through the inner two-thirds of the uterine wall while the thin walled, valveless and easily compressible veins run radially outwards from the endometrium. The endometrium contains the abundant terminations of the supply and return systems together.

So long as the return channels are capable of accommodating the supply a proper balance is maintained and a break does not occur. On the other hand any marked over supply producing congestion and swelling of the uterine wall embarrasses the return channels by pressure through their thin walls and their active capacity is impaired. The coincident

congestion, swelling and softening of the endometrial elements provides a weakened link in the whole system and unless the impediment to the return channels is removed by relaxation or softening of the uterine wall a break in the weakened portion is the usual result.

The incidence of the menstrual flow is therefore the result of an accidental break in the endometrial portions of the irrigation system brought about by intense congestion and softening while the return channels are embarrassed and inadequate to take care of the supply. As the unloading takes place by diapedesis and through small breaks in the endometrial plexus of terminal veins it is gradual and extends over a period of time, during which the active congestion of the supply channels is receding and normal return is being re-established. Following the termination of the flow there is a rapid return of the uterine wall and endometrium to a quiescent state.

The infantile uterus is long and narrow with its cervix relatively larger than the body. Active, free circulation throughout its component parts is readily maintained. With its assumption of the adult type the body becomes much larger with its walls thicker, firmer and more elastic and while the endometrium is sharing in the added development it becomes further removed from its source of blood supply and a continuation of a supply adequate to further its development and bring it to a proper state of fertility and maintain it so is rendered more difficult by the changes in the uterine walls. It is at this stage that the irrigation process is established and so long as this process continues to function the uterus maintains its adult characteristics. When it is permanently discontinued the uterus becomes atrophic without reversion to the infantile type.

Coincident with the change from the infantile to the adult type of uterus the ovaries, having reached a mature state of development, take on the function of ovulation and formation of lutein bodies, and as the result of ovarian activity the irrigation process is established. It does not necessarily follow, however, that monthly irrigation is at once inaugurated, and some time may elapse before there is definite periodicity, and a regular loss of balance between supply and return with consequent regular flow may be delayed still longer. The occurrence of pregnancy in this state is not precluded once ovulation has begun.

It is now well established that in the various phases of the menstrual cycle structural changes occur in the ovaries and coincident with these are changes in the endometrium through which it passes from the quiet resting state to the active engorged state of the premenstrual phase. Ovulation with rupture of the Graafian follicle marks the post-menstrual phase, occurring, on the average, within two weeks from the onset of the previous flow. It is at this time that impregnation is most likely to occur because the ovum is in transit and the endometrium is in a receptive state. Following the rupture of the Graafian follicle the corpus luteum is built up on the same site and reaches its highest state of development in the premenstrual stage. Its retrogression begins with the onset of the flow.

Clinical research would appear to support the belief that the corpus luteum presides over the irrigation process. Its presence is so constant in the premenstrual phase that one can practically always recognize it in

one or other ovary while operating on the pelvic organs in this stage. The closer to the anticipated flow the higher is its state of development. If removed in the immediate premenstrual stage the flow may be little affected but in numerous instances in which it has been removed in the more remote part of the premenstrual stage the anticipated flow has been scant or absent. In cases of lutein cyst in which the lutein body has been excessively developed and when bleeding has been greatly in excess, removal of the affected ovary or excision of the cyst from the ovary has been followed by prompt cessation of the bleeding, that is, within two or three days.

With the cessation of ovarian activity at the menopause menstruation ceases and a similar result follows the surgical removal of all the ovarian tissue or its destruction by ray treatment. The causative factor of menstruation, therefore, can at least, without question, be assigned to ovarian activity. This, however, may be influenced by the action of other internal secretory glands, notably the thyroid. Likewise it is subject to other influences such as climate, location, occupation, environment, state of the blood and cardio-vascular system, nervous mechanism, and general state of health.

As to the matter of control in the amount of bleeding one does not need to look to any inhibitory function of the ovaries provided that the causative factor is not in excess and is exhausted in due time as is ordinarily the case with the rapid retrogression of the corpus luteum. The muscle of the uterus provides the controlling mechanism and adequately meets the situation, provided that its contractility is unimpaired and there is no excess or prolonged action of the causative factor. During the menstrual flow the firm uterine muscle in its congested and swollen state maintains sufficient compression of the radial veins to prevent inordinate reflux and escape through the small breaks in the endomentrial plexus. At the termination of labor with the separation and expulsion of the placenta a post partum haemorrhagic reflux from the enlarged veins or venous sinuses is prevented by compression brought about by contraction of the uterine muscle until such time as organization and permanent sealing take place. This is by far the most noted example of uterine control and is absolutely independent of any ovarian function. Not only is it manifest at the normal termination of pregnancy but it is effective at any time that the uterus is relieved of its contents either by early or late abortion or by vaginal or abdominal hysterotomy. Enucleation of a large fibroid from the uterine wall is immediately followed by contraction of the muscle. Even after its extirpation the uterine muscle retains active contractility for some time as is evidenced by the rapid contraction of the muscle around a fibroid tumor when the tumor is split open by an incision extending through the surrounding muscle.

Although the periodical irrigation process is usually attended by an actual loss of blood this is not essential to its continuation. It provides, however, a definite indication that the process is going on and minute details regarding the periodicity, the amount and duration of the flow give important information as to the continuation of the normal state. In some instances all the attending symptoms of menstruation may be in evidence except the loss of blood. In such the pre-menstrual congestion

is insufficient to thoroughly overload the endometrium or there is some diminution of the impediment to the return channels so that a balance between supply and return is maintained. In other cases a flow occurs at long intervals only.

The ordinary amenorrhoea of pregnancy is the result of removal of the impediment to the return channels on account of softening of the uterine walls which is one of the earlier effects of pregnancy. As impregnation usually occurs in the post menstrual stage, by the time the ensuing irrigation is due the uterine muscle is so generally softened that the capacity of the return channels is capable of taking care of the supply and a break does not occur. In cases in which pregnancy antedates the last menstrual flow, often more scant than usual, implantation has probably occurred in the premenstrual stage and during the ensuing irrigation the uterus is not generally or sufficiently softened so as to permit maintenance of balance without a break.

Occasionally but rarely a woman continues to menstruate regularly throughout pregnancy. More frequently a flow is seen regularly during the first three or four months, and under such circumstances it is not unusual to find the uterus irregularly softened. The breaks are more likely to occur in relation to the non-softened areas and as these are usually not at the site of implantation the bleeding may not interfere with the progress of pregnancy. Many women during the early months of pregnancy experience menstrual symptoms without a flow. Spontaneous abortion is most likely to occur in the early months of pregnancy at times corresponding to the menstrual periods. Following the termination of pregnancy a regular monthly flow is not re-established until the uterus returns to its ordinary state of firmness. The time required for this is most variable and is frequently prolonged by lactation. Women not infrequently become pregnant during lactation while there is still amenorrhoea.

On account of such clinical observations as these one cannot accept any dictum to the effect that ovarian activity is in abeyance during the amenorrhoea of pregnancy and lactation. While the structural changes in the ovaries may be influenced to some degree by the occurrence of pregnancy, an accomplished purpose, there is ample clinical evidence to suggest that the irrigation process is continued, if not throughout the whole period, at least during the early months.

The corpus luteun which comes on irrigation duty when pregnancy occurs would appear to be accorded special and prolonged service. There is need of quick and continuous action. The flushing of the uterus must be continued in order to maintain the life of the implanted ovum, at least until such time as the general state of vascular engorgement and the formation of a placenta permit free access of maternal blood to the foetus. If ordinary rapid retrogression of the corpus luteum occurred at this juncture the endometrium would return to its inactive state and the rapidly developing ovum would not only find its digging more difficult but would suffer starvation in the meantime. It is doubtful if on its own initiative it could command enough engorgement and softening to carry on. For this added duty the corpus luteum attending pregnancy is developed

to unusual proportions and its retrogression may be delayed to the third month or until the need of continuous duty has been relieved. That it may be reinforced by others developing periodically during its term of duty is not unlikely in view of clinical evidences of the continuation of the periodical irrigation. Clinical evidence in this particular regard is of necessity difficult to acquire and some doubt might arise as to whether the corpus luteum of pregnancy is the one actually persisting for so long a time or whether it is not sooner replaced by another.

THE PHYSIOLOGY OF MENSTRUATION

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The conception of the physiology of menstruation has undergone many changes during the past fifteen years, due mainly to the work of Hitchman and Adler, who were probably the first to outline in detail the changes in the mucous membrane of the uterus at the various stages of menstruation.

Menstruation is intimately connected with ovulation, which is a fundamental process in which the main factor is the ovum. The Viennese school of investigators believe that the corpus luteum has two main functions. First that it produces a hormone whose function it is to make the mucous membrane of the uterus hyperaemic so that it can menstruate, and second that it protects a pregnancy within the first three weeks.

To illustrate the relation of ovulation to menstruation we will take, for example, a cycle of thirty days. In such a cycle the rupture of the Graafian follicle will take place twelve to fourteen days after the last day of the last menstruation, and in a few hours the ovum is at the opening of the tube and is moved by the cilia and the contractions of the tube, so that in about ten days it is in the uterus. The life of an ovum is limited to twelve to fifteen days, and if it meets the sperm either in the tube or uterus it is impregnated. If not impregnated it will die either in the uterus or in the vagina, whose acid secretion soon kills it if it is not already dead when expelled from the uterus.

One to two days after ovulation the epithelium of the follicle becomes converted into the corpus luteum, and by the time the premenstrual stage is reached the corpus luteum is at the height of its development. From this point on, the future life history of the corpus luteum seems to depend on whether or not the ovum has become impregnated. If impregnation does occur we know that the function of the corpus luteum continues probably throughout the greater part of the pregnancy, being of greatest value in protecting the pregnancy during the first three weeks, during which time, if the corpus luteum be extirpated, abortion inevitably occurs. After this time the placenta appears to be able to protect the pregnancy. If impregnation of the ovum does not occur, it dies, and one or two days after the death of the ovum the function of

the corpus luteum seems to cease and a day or so after this menstruation occurs. Therefore between the ovum and the corpus luteum there is a very intimate relation. The corpus luteum serves as pacemaker to the ovum, and if the ovum dies the corpus luteum degenerates and the mucous membrane of the uterus menstruates or collapses.

The post menstrual mucous membrane is thin and anaemic and glands and stroma show no signs of activity. From this to the premenstrual stage we have a gradual transition to a very much thickened and very hyperaemic mucous membrane with signs of marked activity in both stroma and glands. The latter show the most striking changes. The mouths of the glands appear to be more or less closed or constricted and show no secretion in this portion, which Fraenkel has called the Layer of Efferent Ducts. The middle layer, called the Active Portion, represents the very tortuous, active, dilated portion filled with secretion. The deepest portion, or Inactive Fundus portion, represents the fundus of the glands and contains little or no secretion. The stroma also shows change as result of the increased hyperaemia. The cells near the surface become very swollen and closely packed together and are called the Layer of Swollen Stroma cells, and it is this layer which by its tension is thought to cause the constriction of the mouths of the glands. The stroma cells deeper in are also very oedomatous but more loosely arranged and in this portion are most of the capillaries.

Before menstruation the mouths of the glands are constricted from the tension of the mucous membrane induced from the hyperaemia caused by the hormone of the corpus luteum. Fraenkel claims to have proven that the secretion of the glands, especially at the premenstrual stage, contains an enormous amount of ferment very like pancreatic trypsin in its properties. If the ovum is impregnated the corpus luteum does not degenerate and menstruation does not occur. If the ovum dies or does not become impregnated then the corpus luteum degenerates and as a result the hyperaemia induced by its hormone is lessened and therefore the tension of the mucous membrane is decreased, and the mouths of the glands or Layer of Efferent Ducts open up. As a result the secretion from the glands pours out and there begins a partial self digestion of the surface epithelium and also of the stroma to varying depths and blood vessels are opened up and menstruation occurs. We know that menstrual blood does not coagulate due to being mixed with uterine trypsin, and there is no doubt partial self-digestion of the mucous membrane, because examination of the menstrual flow shows besides blood, gland secretion, oedema fluid, and desquamated mucous membrane remains.

Hence we can say that the corpus luteum prepares the mucous membrane to menstruate if the ovum does not become impregnated, or that the abortion of the non-pregnant ovum is followed by menstruation.

JAUNDICE

SECOND PAPER: SOME CLINICAL CONSIDERATIONS

J. E. WALKER, '25

(Condensed from a paper read before the Alpha Omega Alpha Fraternity on January 12, 1925.)

During the past three-quarters of a century a very considerable amount of research work has been carried out on the normal and abnormal metabolism of the bile pigments in the animal economy; in consequence of this work we have been forced to change our views to a large extent regarding the production of the pathological condition known as jaundice. The theories as to the production of jaundice have travelled, like many another theory, in a circle back to the old original starting-point; from Virchow in 1847, who claimed that there was both obstructive and haemolytic jaundice, we change our minds later with Minkowski, Naunyn, Eppinger and many others who contended that all jaundice was due to obstruction in the liver; with the present-day investigators such as Rich, McNee and Van Den Bergh, we gain our modern conception of bile pigment metabolism and its pathological disturbances as set forth in the article on Jaundice in the March number of this JOURNAL.

To bring the clinical varieties of jaundice into accord with the modern conception of the etiology of jaundice, the following classification has been devised.

I. *Obstructive Hepatic*
1. Obstruction in the lumen of bile ducts—*E.g.*, stone.
2. Changes in the walls of the bile ducts—*E.g.*, cancer of duct.
3. Pressure on the bile ducts from without—*E.g.*, cancer of the head of the pancreas.

II. *Toxic and Infective Hepatic*
1. Chemical poisons—*E.g.*, arseno-benzol derivatives, inorganic phosphorus and arsenic, chloroform, tetrachlorethane, trinitrotoluene.
2. Bacterial poisons—*E.g.*, typhoid, pneumonia, influenza.
3. Protozoal poisons—*E.g.*, syphilis.
4. Auto-intoxications—*E.g.*, uraemia.
5. Poisons of unknown origin—*E.g.*, acute yellow atrophy, eclampsia.

III. *Haemolytic*
1. Chronic haemolytic jaundice—familial and acquired.
2. Pernicious anaemia.
3. Chemical poisons—*E.g.*, arsenuiretted hydrogen.
4. Bacterial poisons—*E.g.*, blood infections.
5. Intestinal worms—*E.g.*, bothriocephalus.
6. Physiological jaundice of the new-born.

IV. *Combinations*
1. Obstructive hepatic with Toxic and Infective Hepatic—*E.g.*, catarrhal jaundice.
2. Haemolytic with Toxic and Infective Hepatic—*E.g.*, arsenuiretted hydrogen.

When we come to study the signs and symptoms dependent upon, or accompanying abnormal metabolism of bile pigments, we are often at a loss to know to which of the possible factors which may be present, we should ascribe the presence of such and such a symptom. Beyond mentioning the possible factors at work in the production of these symptoms, we do not purpose to go further into this matter. The four possible factors involved are, first, the increased quantities of the bile constituents, chiefly bile pigment, bile acids and cholesterol, in the blood stream; second, the absence of these same constituents from the alimentary tract; third, the presence of an infection or toxin which may be the cause of the jaundice; fourth, an impairment of the other hepatic functions due to obstruction of biliary outflow,—the most important in this connection being the protective barrier action of the liver against the absorption of poisons manufactured in the intestine.

The signs and symptoms found in obstructive hepatic jaundice vary considerably from those found in haemolytic jaundice, so the symptoms found in these conditions will be described separately.

Obstructive hepatic.—There is pigmentation (varying from light yellow to dark green) of the skin and mucous membranes of the body; pigmentation does not occur, however, until there are four units of bilirubin present in the blood serum. Most of the normal secretions of the body do not become bile-stained; the saliva and the mucous secretion of the mouth and alimentary tract are never bile-stained, while perspiration, tears and mother's milk are more often unstained than stained; pathological exudates such as pneumonic sputum, are stained. In the urine, bilirubin appears even before it is seen in the conjunctiva; urobilin is present only in small quantities, but it is claimed that this is increased with the absorption of the bile pigment from the tissues of the body. Pruritus or itching is present in about 20% of cases, and there is considerable variation between the time of appearance of this symptom and the time of appearance of the pigmentation in the skin. Yellow vision not infrequently occurs, but is seldom of sufficient annoyance to the patient to cause much comment on his part. Other symptoms that may be noted are: Slowing of the pulse (particularly in recent jaundice); the blood pressure is usually low; a mitral systolic murmur and accentuation of the second pulmonic sound may be present; the respiratory rate is slowed or normal; the temperature may be depressed; the coagulation time and bleeding time of the blood are prolonged; the red blood cells are said to be more resistant to hypotonic salt solution; there may be mental symptoms of depression, drowsiness, stupor or coma. Lastly there is a group of symptoms whose presence is explained by the absence of bile from the alimentary tract, namely, chronic constipation, and the production of a stool which is bulkier than normal and which is clay-coloured.

As opposed to these symptoms in obstructive hepatic jaundice there are some general signs and symptoms that hold for *haemolytic jaundice.* In this latter condition the amount of pigmentation is usually slight. The urine in uncomplicated cases does not contain bilirubin but does contain increased amounts of urobilin. Bile acids are not retained in the blood. There is no bradycardia, pruritus or yellow vision. Bile pigments and salts are present in the intestines so that the stool is normal and constipation is not a feature. In chronic haemolytic jaun-

dice (familial and acquired) the red blood cells are less resistant than normal to hypotonic salt solutions.

In the *toxic and infective hepatic* jaundice the symptoms are more variable, depending to some extent on whether the principal lesion is an obstruction in the ducts or a degenerative or inflammatory change in the hepatic polygonal cells interfering with their excretion of bile pigment.

Of the various laboratory tests which may be employed in the clinical study of jaundice, the Van Den Bergh reaction is in many ways the most helpful, and has been the means of many of the most recent advances in the understanding of bile pigment metabolism. To Hymans Van Den Bergh, professor of medicine at Utrecht, must belong the credit of introducing the test known by his name into the realm of clinical medicine. In 1883, Ehrlich discovered that if a small amount of diazonium salt in acid solution be added to an alcoholic solution of bilirubin, there developed an azo-dye, namely, azo-bilirubin. In 1900, Prôscher did some further investigation on this reaction, but apparently neither thought to apply it to the study of the blood serum in jaundice. A little prior to 1913, Van Den Bergh came on the scene with a new idea. He felt convinced that too much attention was being paid to the colouration of the skin and mucous membranes and to the appearance of bile pigment in the urine and feces in the condition of jaundice, whereas the fundamental consideration was the presence of bilirubin in the serum. Searching around for some means of studying this condition, he finally came across the diazo reaction of Ehrlich and Prôscher, which he found gave an accurate test both qualitatively and quantitatively, for small quantities of bilirubin in small quantities of serum. Moreover, he found that bilirubin is the only substance which reacts with the diazo reaction in an acid medium, so that we can now, using this specific test, talk about "blood bilirubin" in the same way in which we are accustomed to speak of "blood sugar" and "blood urea." For a description of the technique of this reaction, the reader is referred to "A Consideration of Some Liver Function Tests" in Vol. I, No. 3, of this JOURNAL, but a few words must be said here in connection with the general interpretation of the test.

I. *Qualitative Reaction*

1. Prompt direct—Given by bilirubin that has passed through the hepatic polygonal cells.
2. Delayed direct—Given by bilirubin that has not passed through the hepatic polygonal cells.
3. Biphasic direct—Given when both varieties of bilirubin are present.
4. Indirect—Given by bilirubin that has not passed through the hepatic polygonal cells. The indirect is used in preference to to the delayed direct reaction.

II. *Quantitative Reaction.*—This is a colourimetric application of the indirect reaction. Dilutions of serum are compared to an artificial standard solution of iron sulpho-cyanide dissolved in ether in such proportions that the solution corresponds to a 1 in 200,000 solution of azo-bilirubin. This dilution is taken as one unit of bilirubin.

With this introduction we turn to the clinical application of this reaction.

1. Normal adult. (i) Serum—contains .2-.5 units of bilirubin giving the indirect reaction.
   (ii) Gall bladder bile—contains up to 50 units of bilirubin giving the prompt direct reaction.
2. New-born Infant. (i) Serum—contains a higher content of bilirubin giving the indirect reaction than in the normal adult.
3. Obstructive hepatic jaundice. (i) Serum—contains up to 50 units of bilirubin giving the prompt direct reaction.
   (ii) The depth of colouration of the skin bears no relation to the amount of bilirubin present in the serum. The depth of colouration depends on chronicity of the disease and the darker colour is due to oxidation of bilirubin in the tissues to biliverdin.
   (iii) There must be 4 units of bilirubin present in the serum before bile pigment appears in the urine or in the skin and mucous membranes.
4. Haemolytic jaundice. (i) Serum—contains up to about 18 units of bilirubin giving the indirect reaction.
   (ii) Urine—in uncomplicated cases, bilirubin does not appear in the urine.
5. Toxic and infective hepatic jaundice. (i) Serum—The prompt direct or the indirect reactions may be obtained from the serum, depending on the lesion which is present in the liver. The lesion may be an obstruction in the ducts due to cholangitis or to a swelling of the polygonal cells; or the lesion may be a derangement of polygonal cell function preventing excretion of bilirubin through them. In some cases both types of lesion may be present with the result that both types of bilirubin are present in the serum, and in these cases a biphasic direct reaction is obtained.
6. It is in the field of latent jaundice that the Van Den Bergh reaction becomes of peculiar value. Latent jaundice is defined as a condition in which there is retention of bile pigment in the blood serum insufficient to cause colouration of the skin and mucous membranes and not giving rise to biliuria. In the haemolytic group we may take pernicious anaemia as an example; in these diseases there is usually some pigmentation of the skin, but in some cases this is not found. In these cases the blood bilirubin is slightly raised, and even during the periodic remissions its value is never subnormal. This is of diagnostic value as opposed to some of the secondary anaemias in which the blood bilirubin is usually low.

   As one may imagine, a condition of latent obstructive hepatic jaundice might exist when the obstruction to biliary outflow is slight.

   In the toxic and infective hepatic group an interesting example is found in the salvarsan treatment of syphilis.

During such a treatment the appearance of jaundice is one of the complications most feared; by judicious use of the Van Den Bergh test, the condition may be forestalled by discontinuing treatment as soon as a rise in blood bilirubin is noted.

(The first article of this series on Jaundice, discussing the normal and pathologic physiology involved, appeared in the March issue of the JOURNAL.

REFERENCES

University of Toronto Medical Journal: Vol. I, No. 3. "Consideration of Some Liver Function Tests."
Rolleston: Diseases of the Liver, Gall Bladder and Bile Ducts, London, 1912.
McNee: Quart. Journ. Med., 1923, xvi, 390.
McNee: Brit. Med. Jnl., 1925 (Sept. 27).
Pearce: The Spleen and Anaemia, Phil. & Lond., 1918.

THE JOURNAL is not exactly a magazine of verse. But we take the liberty of passing on to our readers this month a striking poem by Amy Lowell, entitled "The On-Looker". As an illustration of the delicate use of symbolism, we believe it is almost unique. One is all but tempted to quote William Cowper, from whose pen came the line,

"There is a pleasure in poetic pains."

THE ON-LOOKER*

BY AMY LOWELL

Suppose I plant you
Like wide-eyed Helen
On the battlements
Of weary Troy,
Clutching the parapet with desperate hands.
She, too, gazes at a battle-field
Where bright vermillion plumes and metal whiteness
Shock and sparkle and go down with groans.
Her glances strike the rocking battle,
Again—again—
Recoiling from it
Like baffled spear-heads fallen from a brazen shield.
The ancients at her elbow counsel patience and contingencies.
Such to a woman stretched upon a bed of battle
Who bargained for this only in the whispering arras
Enclosed about a midnight of enchantment.

*Published by kind permission of the author and of *The Saturday Review of Literature,* New York.

MENTAL TESTING

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It is a matter of common observation that individuals differ greatly in their ability to perform particular tasks or to cope with ordinary situations of daily life. These variations in ability, known psychologically as "individual differences," are among the most important and basic facts in personality. While each of us may have his own way of estimating the general ability of others, to enunciate a scientific method of measuring individual differences has proved as difficult as it is an important problem.

Several considerations contribute to the difficulty of this task. While the most certain criterion of ability is performance, it is desirable, with persons no less than with physical nature, to be able to make a reasonably accurate forecast of what may be expected on the side of performance. Actual accomplishment by an individual, however, may turn upon other factors than those of natural endowment, *e.g.*, special opportunity, or upon certain moral qualities and attitudes which may be themselves the product of experience. For these and other reasons it is convenient in psychological study to draw a distinction between the native ability of a person and special proficiencies which he may have acquired through environmental circumstances peculiar to him, the former being intrinsic to the individual and the latter more or less accidental. In practice this distinction must not be too rigorously drawn because the so-called native ability cannot be abstracted and studied as an entity; it can only be examined in so far as it functions in relation to one or another environmental setting. In fact the distinction may be accepted as meaning nothing more than the fact that standard situations can be selected and that individuals may be compared (and their native ability be measured) in terms of their responses to these trial conditions. The significance of such measurement in a diagnostic sense clearly depends upon the question of whether a subject's ability to respond under all sorts of circumstances can be determined by sampling his behaviour under a few situations scientifically selected and controlled. Although it might challenge one's self-conceit to consider this possible the question is one to be answered by experiment, not by opinion, and the fact is that within certain limits it can be done with a surprising degree of precision and consistency. Broadly speaking, therefore, the test principle consists in presenting a selection of standardized situations in order to diagnose from a subject's success with these what will be his success with other more complex situations in life. The resulting measurement will be an indication of his inherent ability for adjustment, *i.e.*, of his mental endowment or intelligence.

Owing to the extreme complexity of mental processes a mental test usually embodies several types of trial situation each of which is a unit or element of examination. These units are devised to test ability from those angles that psychological research has demonstrated to be the most significant from a predictive standpoint. They require on the subject's part a certain power of being able to change gears mentally without stalling. Test construction is no longer a haphazard under-

taking but rests on definite principles and utilizes a well-known method, viz., that of mathematical correlation, for determining the contribution of each element to the total mental rating. In a properly standardized test no element will be found whose relative value is not thus objectively known through extensive preliminary inquiry. This point requires emphasis because the apparent simplicity of the best existing tests occasionally tempts the uninitiated into believing that a psychological test can be compiled as an after-dinner recreation. The difficulty lies not so much in suggesting test elements as in evaluating the responses thereto. That is to say, the standardizing of a test largely consists in proving that the ability of subjects to respond to the test correlates significantly with their ability in practical situations as judged by objective performance subsequently observed. And it follows that a standard test must not be modified by an examiner without re-standardization, if valid conclusions are to be drawn from the scores obtained on the test.

In mental rating the individual must be accepted as one finds him, endowed with a certain amount of ability and equipped with a repertoire of habits and other acquired behaviour tendencies. Although his learned reactions may colour his responses to a test, this does not invalidate the test as a measure of native ability because these learned responses are themselves the outcome of his ability previously applied. There is therefore no necessity for attempting to separate native ability from acquired behaviour, it is merely necessary to insure that a test in its entirety shall call upon those capabilities which make learning possible in the sense of successful adjustment to typical situations. From this standpoint capacity to adapt to the demands of environment constitutes what is known as "intelligence," an intelligence test being a means of quantitatively measuring individual differences in respect of this capacity. Both the content of a test and the grading of responses is determined through investigation of large numbers of subjects selected at random as representative. The norm adopted in the measurement of intelligence is therefore never one arbitrarily imposed upon a subject from without; it is derived as a scale from the performance of subjects themselves. The main advantage of the scientific method in this field is that the intelligence of the individual is measured by comparison with that of his fellows and by a rigorous objective procedure rather than by the personal opinion of one or another interested individuals. In utilizing tests, however, it must be borne in mind that they do not plumb all the depths of human action; the emotional factors, so vital in behaviour, seem to be beyond their reach.

The present-day conception of intelligence testing is the product of more than a century of scientific endeavour to measure the psychical and character differences of individuals. In the eighteenth century the attempt was based upon external physical traits—chiefly of physiognomy, and this has survived in certain quarters as a remunerative art although lacking in the support either of an adequate theory or of critical empirical verification. A more systematic approach was made in Italy by criminologists who sought to show that atypical physical characters were signs of innate criminal tendencies—misshapen ears, brow, palate, etc. The rise of sound methods of statistical proof soon showed that the presence (or absence) of such stigmata was not a trustworthy criterion of character

or behaviour. Few individuals in fact are entirely free of all of these physical "stigmata." This conception, however, had the merit of drawing attention to the problem of individual differences on the physical side. Another direction was given in the early nineteenth century through the recognition which the central nervous system was then receiving as basic in the control of function. The shape and prominence of parts of the cranium was now the clue to mental differences. This phrenological conception was implemented by the contemporary psychology which regarded mental processes as belonging to one or another well-marked mental "faculty"—Memory, Will, etc.—each being supposed to have a distinct location in the brain. As a method of investigating mentality little of this view now survives. Moreover in neurology a rigid conception of the localization of brain function is of late being questioned.

The pioneer psychological work of Galton in England and of experimental psychology generally, in Europe and later in America, gave a new approach to the study of mental life. And the rise of statistical methods of investigation and proof coincidently with this at once bore fruit in the study of individual differences. The principle was now accepted that mental processes must be studied in terms of mental rather than of purely physical facts. But notwithstanding this advance in outlook the goal of measuring human ability proved difficult to attain. The earliest attempts from this new angle were in terms of the lower senses—thresholds of touch, of weight discrimination, etc. But this proved a false trail for it was soon revealed that imbeciles of obviously low mentality were not significantly deficient along these lines. And a similar negative result was later established with regard to the higher senses, sound and sight. Although these investigations into individual differences in sensory processes had little significance for the diagnosis of general ability, they have other practical applications. They are, for example, the main basis upon which persons are selected as having unusual ability for certain highly specialized tasks both in war and in peace—submarine listeners, ball-bearing sorters, etc. But psychological research, having obtained its start as an inductive science, rapidly advanced. The next stage (about the turn of the present century) brought it into the field of function. On the objective side this involved studies in reaction time, rate of tapping, dynamometric tests, etc., and on the subjective side, perception processes, the span of attention, associative learning, and so forth. The precise quantitative methods here applied added greatly to the existing knowledge of mental life, especially of the higher processes, but a measure of general ability remained still to seek.

A further change in point of view which finally brought success was due primarily to Binet in Paris, although Spearman in England, Ebbinghaus in Germany and Cattell in America were working along somewhat similar lines. Binet (and Simon), being commissioned to inquire into the question of backward children in the schools of Paris, ceased making precise measurements of particular mental processes and decided instead to deal with the gross response of the individual to a controlled situation. Secondly, Binet accepted from biology the view that mental development keeps step with physical development (*i.e.* parallels chronological age during the period of physical growth), and

he applied this notion in the form of a scale of year-age performances. That is to say, he investigated and verified the point that a commonplace task can be selected which, for example, is possible of accomplishment for the majority of five-year-olds, is impossible for the majority of four-year olds and is possible for all but a small minority of six-year-olds. This he considered would be a standard five-year test. On this basis Binet picked out five tests appropriate for each year-age from 3 to 10 years and his psychological skill is evidenced by the fact that he included in the tests for each year ones that called upon all of the more important higher mental processes. This assemblage of unit tests formed his now famous scale for mental measurement.

By allowing a credit in months for each unit of the scale the performance of a child upon the entire scale could be computed in terms of years and months, the total of credits giving his "mental age;" and this might turn out to be greater than, equal to, or less than, his actual chronological age at the date of testing. Thus if two children each nine years of age prove to have mental ages of ten and seven years respectively on the Binet scale, the significance is not merely that the one is brighter than children of his age and the other considerably duller, but also it means that one may safely predict that this will continue to be the case as these children grow up. The difference between them is not an accident of training or of experience, it is a difference in native endowment and as such it cannot be eradicated by special training. But this does not mean that nothing can be done; it means that for them training should be adapted as far as possible in order that they may utilize to the best advantage that degree of capacity of which they are possessed.

Binet's conceptions and investigations revolutionized the work in mental testing. His scale has been several times revised, *e.g.*, by Goddard and by Terman in America and by Burt in England, but the changes have been in points of detail rather than of principle. That his principle of mental testing is sound and exceedingly useful in the fields of education and of psychological medicine is now almost universally conceded. No such claim, however, can be made for all of the various extensions of the test principle that have grown up in the past decade or so, and the student will appreciate that a thorough knowledge of the literature and work in this extensive field is necessary before venturing to pass judgment upon particular phases of it. The technique involved in "Group Intelligence Tests," for instance, is quite different from that employed in Binet's "Individual Intelligence Test" but the results with group tests though not so precise may be nearly as valuable and the cost in time much less. Again, tests have been devised for other purposes than the examination of general intelligence as above defined—for special abilities (and disabilities), for vocational aptitudes, for acquired proficiency in particular subjects (scholastic tests), for skill in various manual operations, for character and temperament, for emotional instability, etc., etc. The majority of this work should be regarded as still in the experimental stage although some of the procedures have already reached a fair stage of standardization.

Individual and group intelligence tests in their very nature pertain to a broad cross-section of the population rather than to a highly selected group who have approximately the same degree of mentality. For this reason intelligence tests find their most useful application in connection with the public school or in a situation such as that presented by the

draft army in the United States. In institutions of higher education, where students are of necessity already highly selected intellectually and where the individual differences are dependent upon a great many other factors the value of intelligence tests is more problematical.

It is not possible in this article to discuss in detail the public school problems to which mental testing may contribute—problems of grading and promotion, problems pertaining to mentally superior children, to mentally defective children, etc. More rapidly now than ever before the method of science is finding its way into these difficult fields and is giving us a clearer vision of the facts and therefore of what the problems really are. One objection to mental testing (now less frequently heard than formerly) is that if a child is given a mental test his intelligence must *ipso facto* be suspect. This is a complete misconception of the purpose of a test and should be corrected wherever it is met. The aim of testing is to ascertain the degree of ability be it great or small in order that the training and care of the individual may be gauged to be in accord with this basic factor. The problems on the side of education and of mental health are not less difficult or pressing in the case of superior children than of those less liberally endowed by nature. The fact is that individual differences exist and are probably greater on the mental than on the physical side. In any grade of a large public school, for example, there are children who, in terms of native endowment, are superior, normal, dull normal or definitely subnormal. Are these children all to be taught the same things in the same way? Can it be done? Some basis of classification of pupils is essential and here mental tests are undoubtedly of value. They do not solve our school problems, the means toward a solution being a matter of educational policy, they merely furnish reliable information regarding the educability of children which is essential to the formulation of a policy.

In as much as the practice of medicine necessarily brings practitioners into touch officially or unofficially with the problems of individual mental development and of adjustment the laity is entitled to expect from practitioners the fullest knowledge that science has to offer in these fields.

For students who are interested in the subject of mental testing, but who have not studied psychology, the following books are suggested:

(1) The measurement of intelligence—L. M. Terman—Houghton Miffln Co, 1916

(2) Intelligence testing—R. Pintner—Holt and Co., 1923.

(3) Mental and scholastic tests—C. Burt—King and Son, 1922.

(4) Psychological tests of educable ability—Report of the British Consultative Committee, 1924.

THE CAUSES OF DYSPHAGIA

E. Clark Noble, M.A., '25

In order to better understand the causes of difficulty in swallowing, it might be advantageous to review briefly the physiology of the normal act of deglutition. The food, after being masticated and lubricated with saliva in the mouth, is gathered into a bolus largely by the action of the tongue against the palate, and then, by the elevation of the tip of the tongue, is directed towards the posterior wall of the pharynx. This, according to Macleod, constitutes the first stage of swallowing, and is purely a voluntary act.

At the moment the food passes backward, there is a slight contraction of the diaphragm, the "respiration of swallowing," the mylohyoid muscles contract, and the bolus passes behind the pillars of the fauces. Afferent impulses to the medulla are set up which initiate the second stage of swallowing. There is a momentary inhibition of respiration and a co-ordinated series of involuntary movements of the pharyngeal muscles are brought about, by which all the openings of the pharynx are occluded or satisfactorily guarded so that the food passes backwards into the oesophagus.

The passage of the food along the oesophagus constitutes the third stage of swallowing. A typical peristaltic wave is set up as the food passes the pharynx, by which solid food is carried to the cardia normally in about six seconds. In the upper two-thirds of the oesophagus, which consists of striated muscle, the wave travels more rapidly than in the lower non-striated portion. In the upper part the transmission of the wave is dependent upon the integrity of the vagus nerve, while in the lower upon an inherent property of the muscle. When liquid or semi-fluid is swallowed, it initiates the usual peristaltic wave by its passage through the pharynx, but by the action of gravity, reaches the cardiac sphincter before the arrival of the wave. Thus fluid either accumulates in sufficient volume to force the sphincter, as in rapid drinking, or else awaits the arrival of the wave, which causes a relaxation of the cardia.

Accordingly, therefore, the causes of dysphagia may be divided into three main groups:

1. Dysphagia due to *mechanical obstruction.*
2. Dysphagia due to *nervous causes without obstruction.*
3. Dysphagia, due to *pain.*

I. Dysphagia due to mechanical obstruction.

In considering the first group we find a typical history of a slowly progressing oesophageal obstruction to be as follows:

The patient usually first notices some difficulty in swallowing solid or bulky foodstuffs, which is not experienced with more fluid material. Regurgitation a moment or two after swallowing soon ensues, very rarely there is vomiting, and later the patient complains of a sense of obstruction in the neighbourhood of the pharynx or upper end of the sternum; actual pain is seldom present. In a patient presenting himself for examination with such a history, we must consider the possibility of the following conditions:

(*a*) *Fibrous stricture* of the oesophagus as a result of swallowing a corrosive substance, such as phenol, bichloride of mercury or Gillet's lye. Very rarely it may be due to syphilis. The history of the case is usually sufficient to enable us to arrive at a diagnosis.

(*b*) *Carcinoma* of the lower end of the oesophagus, or cardiac end of the stomach. The differential diagnosis between these two conditions may at times be almost impossible, at least until the X-ray picture becomes definite. The former is comparatively much rarer than the latter, but should be suspected in all patients over forty-five years of age who give a history of progressive dysphagia together with the regurgitation of the blood tinged food. In the early stages the X-ray frequently fails to disclose the source of the dysphagia. Carcinoma of the stomach involves the cardia in from 10-12% of cases, and the first clue to its presence may be the regurgitation of fluids into the mouth, water brash, or dysphagia on taking solid food. A palpable mass may be detected, and the X-ray give final diagnostic evidence. In both conditions we may have loss of appetite, weakness, secondary anaemia, loss of weight and energy, which symptoms are suggestive, but not distinctive.

(*c*) *Swallowing of a foreign body*, such as a piece of bone or false teeth. Here the sudden onset with the history is diagnostic, while the fluoroscope should be resorted to in its location and removal.

(*d*) *Enlargement of the thyroid gland*, either visible or retro-sternal. In the first type the diagnosis is fairly obvious, although one is not warranted in arriving at this conclusion just because the thyroid is enlarged, for the patient might easily be suffering from such a condition as carcinoma of the cardiac end of the stomach as well. In children the possibility of an enlarged thymus must not be lost sight of.

(*e*) *Aortic Aneurism.* The type most likely to stenose the oesophagus is one affecting the descending aorta, so that many of the classical signs by which aneurism of the arch may be diagnosed are absent. The patient's age ,and the presence of other manifestations of syphilis, should be taken into consideration before a diagnosis is established.

(*f*) *Mediastinal tumours*, such as lymphosarcoma, Hodgkin's disease, lymphatic leukaemia or a primary tumour of the lung. In all of these we may have signs of venous obstruction, diminished expansion of the lungs, displacement of the trachea, hoarseness and persistent cough. In the former, as diagnostic points we have the age of the patient, a mediastinal tumour, as shown by percussion and X-ray, a blood picture of a white blood count usually only slightly increased with a percentage of polymorphonuclear leucocytes of 80 or over, and hoarseness. In Hodgkin's disease we usually have a younger patient, the presence of enlarged glands elsewhere, often an enlarged spleen, a low grade fever of a type which is continuous or may last for two or three weeks, disappear for a similar period and then recur, a characteristic blood picture of an increase in endothelial cells and eosinophiles with at first no change in the total white count, but later a moderate increase, intense itching of the skin and radiographic evidence of a tumour mass. In lymphatic leukaemia, the blood picture is at once characteristic. In primary lung tumour, we have a patient around middle life with a history of persistent cough, a pleuritic pain which is almost constant, diminished expansion, or even rigidity of one side of the chest, a pleural effusion which is usually

haemorrhagic, progressive weakness, loss of weight and secondary anaemia. Puncture of the lung substance with a large aspirating needle may be done for diagnostic purposes.

(*g*) *Oesophageal diverticulae.* This condition, which is relatively uncommon, occurs more often in young people, and should be considered where we are given a history of repeated attacks of dysphagia, which increase in intensity over a period of five or six days, and are relieved by vomiting, only to recur. The use of a bougie, or a fluoroscope and barium meal, usually determines the diagnosis. A pleuro-oesophageal fistula may be a rare cause of dysphagia.

(*h*) *Large pericardial effusion.*

(*i*) We have a group of conditions due to mechanical obstruction not in the oesophagus, but in the mouth or pharynx. *Retropharyrgeal abscess, cervical Pott's disease* with abscess formation, *peritonsillar abscess* and *mumps.*

II. Dysphagia due to nervous causes without obstruction.

In considering the second group of causes, namely, those due to nervous conditions, we have to differentiate the following:

(*a*) *Post-diphtheritic paralysis* of the soft palate. The patients are usually children and complain of regurgitation of fluids into the nose, and difficulty in articulation of certain words. A history of diphtheria may be given, or one suggestive of a mild unrecognized attack. A positive Schick reaction is of value in excluding this cause.

(*b*) *Hysteria*, or spasmodic dysphagia, is probably the second most common cause under this heading and occurs almost always in young women of emotional temperament, who frequently show other manifestations of functional nervous conditions, such as chorea. In *hydrophobia* spasmodic dysphagia is characteristically present.

(*c*) *Bulbar paralysis* from various causes. Here we find a progressive difficulty in the use of the lips, tongue, pharynx and larynx. In the so-called pseudo-paralysis resulting from bilateral cerebral softening, similar symptoms may be present.

(*d*) *General paresis* of the insane. Here dysphagia is a terminal symptom manifesting itself long after the diagnosis has been established on other grounds.

(*e*) *Myasthenia gravis.* In patients suffering from this malady, the affected muscles are able to contract well for a few moments, but very rapidly become fatigued and soon cease to function. The pharyngeal muscles are involved early in the disease and give a characteristic response to faradic stimuli in that the response is at first brisk, soon disappears entirely and returns after a prolonged period of rest.

(*f*) *Peripheral neuritis*, other than post-diphtheritic, may occasionally produce dysphagia.

(*g*) *Bulbar poliomyelitis* is a not uncommon cause of dysphagia in infants and young children.

(*h*) *Tetanus.*

(*i*) *Botulism.* Dyspnoea, cranial nerve paralysis and dysphagia may be prominent symptoms.

III. Dysphagia due to pain.

In the third group of causes, namely, those due to pain, we have a variety of causes which may be briefly enumerated as follows:

(*a*) *Inflammatory conditions* of the mouth and tongue.

(*b*) *Ulceration* of the tongue, whether traumatic, malignant tuberculosis or syphilitic. The latter are characteristically less painful than the others.

(*c*) *Inflammations* of the Pharynx.

(*d*) *Affections* of the larynx—acute tuberculous or syphilitic laryngitis, or carcinomatous ulceration.

The majority of the conditions in this group should be diagnosed by direct inspection and the history.

From the causes set forth, it will be apparent that dysphagia is usually associated with some more or less serious organic lesion, and as the symptom of such should always merit a prompt and thorough investigation.

DIAGNOSIS IN DISEASES OF THE URINARY TRACT

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If an apology for the contents of this article is needed I would urge justification on the ground that, in the diagnosis of no set of symptoms is routine more necessary than those of the urinary tract. If a routine and systematic examination is not carried out, the key to the situation may be lost. For instance, if a patient voids urine before you have examined the meatus for a possible discharge, that opportunity is temporarily lost. At the beginning, then, one should take a careful history with special reference to age, marital relations, and past illnesses, bearing in mind that in a good many cases age is a very important factor.

There are many symptoms which are often misleading; to mention a few, there are the various forms of indigestion in renal infections and renal lithiasis. Also symptoms of acute intestinal obstruction in the same. Ureteral stone and acute seminal vesiculitis simulate appendicitis, and stricture of the urethra and other urinary obstructions simulate prostatic obstruction, to say nothing of the large hydro- or pyonephroses, which have developed without any symptoms at all.

Many and varied as are the symptoms one may find, there are four cardinal symptoms which must be heeded. They are urethral discharge, frequency, pain, and haematuria. Usually, but not always, no matter what other symptoms our patient is complaining of, he has one or more of these.

In taking our history, then, we note if he or she has ever had any venereal disease, as an old prostatitis or seminal vesiculitis is liable to "light up" and cause a bladder infection, or it is quite possible that a slight urethral discharge is due to a stricture, which in turn is a legacy from a former urethritis. The history of a previous chancre may lead

us to suspect a cord lesion; a former pleurisy or pneumonia may point to a tuberculous kidney, and lumbago to a renal condition, or Pott's disease.

After getting a good and thorough past history we may proceed with our examination, which, of course, must include every system. In connection with the urological tract, we first note the reflexes. Then the tongue, teeth, tonsils, etc., as these are probable sources of focal infection of the kidneys, a dry, red tongue, especially in an old man, denoting kidney impairment. Enlarged glands are looked for and the condition of the skin noted. Tenderness or tumours of the abdomen, particularly in the costo-vertebral angle, must be looked for and, if found, differentiated. The differential diagnosis of these it is not our purpose to discuss here, except to state that the text-book description of the tympanitic colon is not always found over the kidney. If the kidney is not large, tympany will likely be present, but a large kidney often pushes the colon aside and rides up to the abdominal wall.

Coming then to the genito-urinary system in particular, the external genitalia should be examined. Induration of one or both epididymes may be a result of a previous gonorrhoea or it may present tuberculous characteristics, such as nodular induration, loss of acute sensation, nodular or thickened vas deferens, attachment to the skin of the scrotum or possibly a healed or discharging sinus. These findings, with a negative history of a former gonorrhoea, and with symptoms of frequency and pyuria, are very suspicious of renal tuberculosis.

The meatus is then examined and if a discharge is present two smears should be taken from within the meatus. The one is stained with methylene blue, and if any organisms are seen the other is stained with Gram's. If one is suspicious of urethral infection the urethra should be stripped, as pus is not always present on examination. The smear having been taken, a male patient is asked to void in two glasses, or a female patient is catheterized. A complete chemical examination is made of the second glass. If urethral infection is to be looked for, the first glass is centrifuged, and if the bladder infection is to be looked for the second glass is centrifuged. Then smears are made of the sediment, and stained with methylene blue, Gramm's, and acid fast stains. Then the diluted sediment is examined with low and high power for pus, casts, red blood cells, etc.

If our patient is a male, a rectal examination comes next, noting haemorrhoids, sphincter tone, size, shape, consistency of the prostate and induration of vesicles and vas deferens. The prostatic secretion is obtained, examined, and stained. In a young man with a large swelling in the rectum, the diagnosis between a large seminal vesiculitis and prostatic abscess is sometimes difficult. A swelling which would here cause confusion would usually result in urinary retention in the latter but probably not in the former. If our patient is in the prostatic age, that is over 50, we next pass a catheter to find the amount of residual urine. If a catheter obstructs and there is no enlargement per rectum and with a previous history of gonorrhoea, we possibly have a stricture which can be diagnosed by bogies or sounds.

Now, if the patient has complained of urethral discharge,we have urethral and bladder smears and we know what is in them.

A urethral discharge is caused by:

1st. Mechanical causes—
- (*a*) Strictures (very common).
- (*b*) Foreign Bodies.
- (*c*) Intra-Urethral Chancre.

2nd. Chemical irritations—
- (*a*) Usually from too strong solutions used for prophylactic purposes.

3rd. Infections from outside—
- (*a*) Specific, *i.e.*, Gonorrhoea.
- (*b*) Non-Specific, *i.e.*, B. Coli. and Staphylococcus.

4th. Infections from above—
- (*a*) Infected bladder.
- (*b*) Infected kidneys.

Therefore, with the knowledge that we have of our smears, the contents of the different specimens of urine, and remembering the above causes of discharge, we should easily trace the infection, at least as high as the bladder, and if reasonable treatment does not effect a cure, then cystoscopic procedure should be advised to determine the more remote causes.

As far as pyuria is concerned, a patient seldom consults us for this condition but fortunately it is usually associated with frequency, pain or haematuria. If, however, one finds pus in the urine its source should be determined as soon as possible, bearing in mind that low specific gravity urine, acid in reaction and showing pus, with no organisms should be considered as very suggestive of a tuberculous kidney.

Dysuria and frequency drive a patient to the physician very quickly Here one should ascertain the kind of dysuria, whether before, during or after micturition. Different forms of obstruction are common causes of dysuria before and during the act, while intense cystitis is a common cause of terminal dysuria, particularly in gonorrhoeal cystitis. In tracing the cause of frequency we must remember that it is due to the following causes:

1. Mechanical obstructions and foreign bodies—
   - (*a*) Prostatic and Vesical Outlet.
   - (*b*) Strictures.
   - (*c*) Calculi-Vesical or Urethral.
   - (*d*) Growths near the Vesical Orifice.
2. Chemical Irritants taken by mouth—
   - (*a*) Turpentine, etc.
3. Infections—
   - (*a*) From below.
   - (*b*) From the kidneys.
   - (*c*) Arising from bladder diverticula, foreign bodies and cystoceles.

In connection with the above it will be readily seen that in the majority of instances we will have a cloudy or infected second glass. The exceptions will be the chemical irritants and obstructions, but the latter will soon become infected if allowed to proceed.

A paradoxical overflow must always be remembered. There is also a class of patient who has a day frequency but does not have to get up

at night. They have clear urine and nothing can be found. Too much acid in the urine is commonly thought to be the cause. In the male it is usually due to an irritable posterior urethra, usually a Veru Montanitis, and is found in early manhood. Later in life it may be caused by early symptoms of prostatism without actual hypertrophy. In the female it seems to be caused by a trigonitis of an unaccountable origin unless we attribute it to some idiosyncrasy of diet. Great frequency in the day time with comparative comfort at night is also suggestive of foreign body, especially calulus.

Haematuria varies from a few unrecognized red blood cells to large clots, and should always be considered serious until proved to be otherwise. Blood in the first glass only usually denotes bleeding from the urethra; mixed blood may be from bladder or kidney, and terminal bleeding is usually due to an intense cystitis. Both glasses are bloody but there is more in the second and pure blood at the meatus, and is always accompanied by great terminal pain. Bleeding is often intermittent, sometimes a year or more intervening between attacks in cases, for instance, of bladder tumour. In early symptomless bleeding one should rule out focal infections and incipient nephritis by the various renal tests, and then have radiograms of the whole urinary tract to exclude, as far as possible, any calculi. Too much dependence, however, should not be placed on these, as a good percentage do not show on the plate. A good purgative should be given before the X-ray is taken to clear away all gas and faecal matter which will obscure the view. One ounce of castor oil or an ounce and a half of Compound Licorice Powder will usually suffice. If the bleeding is accompanied by infection and frequency, a tuberculous kidney should be considered a probability, and if a search for the tubercle bacillus is futile, a guinea-pig should be inoculated. If these tests show nothing, a thorough urological examination should then be made, with a view to ruling out malignancy in the bladder, as well as to find any other possible cause.

Pain always demands relief, but the cause is sometimes deceiving. It is sometimes felt in the kidney other than the one affected, but usually in the urinary tract it is fairly well localized. If one goes about the examination in a methodical way he will usually find the cause. There are, however, many cases of definite renal pain which show nothing on careful examination. On urological investigation many of these cases are found to have a stricture or a kink of the ureter which causes an intermittent back pressure in a very sensitive renal pelvis or a stenosis of the uretero-pelvic orifice. Any of these conditions presents symptoms which are definitely renal and still, to ordinary examination, they show nothing. On the right side, particularly, they are repeatedly mistaken for duodenal ulcer, gall bladder, or appendicitis, being ruled out by a process of exclusion, if considered at all, on the ground that there is nothing in the urine, or X-ray examination. The only possible way to diagnose this condition is by a pyelo-ureterogram.

In the space here at my disposal, I have not attempted a differential diagnosis of any or all conditions, but I have tried to outline a definite method of procedure in examination and mention a few points in diagnosis which, I hope, will be helpful.

To sum up, therefore, I would urge a careful and especially methodical examination, both physical and microscopical, if one is going to get anywhere in making a diagnosis.

ACUTE SUPPURATIVE TENOSYNOVITIS

W. S. Muir, B.A., '25

As tenosynovitis is a condition resulting from the anatomical peculiarities of the hand, its treatment requires a knowledge of the structural arrangement of the parts concerned. A familiarity with these peculiarities may be obtained by building up the various structures about the bony skeleton.

Anatomy

I. General

Between the metacarpal bones lie the dorsal and ventral interossii muscles, enclosed on either surface by a fairly definite fibrous tissue membrane which is attached firmly to the shaft of each metacarpal. Between this layer and the skin on the dorsum of the hand lie the extensor communis digitorum tendons which are connected by bands of fibrous tissue, forming a more or less complete sheet. The structures on the palmar surface may be considered in four layers. Lying on the metacarpals are the adductor transversus pollicis, which really belongs to the interosseous group, and the deep palmar arterial arch. In the next layer are the tendons of the flexor profundus digitorum and the lumbrical muscles. Superficial to these are the flexor sublimis digitorum tendons upon which lie branches of the median nerve and the superficial palmar arterial arch which are covered by the palmar aponeurosis and skin. The thenar eminence consists of the opponens pollicis muscle which lies on the first metacarpal bone and is covered by the flexor pollicis brevis and abductor pollicis muscles. The hypothenar eminence is constructed in a similar manner by the opponens digiti quinti, the flexor and abductor digiti quinti muscles.

II. Tendon Sheaths

A.—On the volar surface of the hand.

1. On the index, middle and ring fingers the tendons of the flexor muscles are enclosed in definite synovial sheaths which are closed cavities. Each sheath begins at the base of the distal phalanx, at the insertion of flexor profundus digitorum tendon and passes proximally to end in the palm. The sheath is closely attached by fibrous tissue over the distal interphalangeal joint and shaft of the middle phalanx but is separated from the metacarpo-phalangeal joint by a considerable amount of fibrous tissue. The proximal ends of the tendon sheaths are marked on the palm by a line drawn from the end of the proximal flexion crease at the index finger to the end of the distal flexion crease at the little finger.

2. The sheath of the flexor longus pollicis tendon begins at the base of the distal phalanax. It is closely attached to the proximal phalanx but is separated from the metacarpo-phalangeal joint by the fibres of insertion of the adductor pollicis muscle. The sheath may end about the middle of the metacarpal bone, or, at this point, present a slight constriction and become continuous with the radial bursa. This bursa acts as a sheath for the flexor longus pollicis tendon in the palm. It passes proximally under cover of the flexor brevis pollicis and opponens pollicis muscles. At the wrist it goes deep to the anterior annular ligament and

extends a short distance into the forearm, deep to and on the ulnar side of the flexor carpi radialis tendon.

3. In the little finger the sheath of the flexor tendon is similar to that on the ring finger, but at its proximal end it usually presents a constriction beyond which it becomes continuous with the ulnar bursa. This bursa is a synovial sac which spreads out over the fourth metacarpal bone and over the proximal end of the third metacarpal. It passes under the anterior annular ligament at the wrist and reaches the forearm deep to the flexor tendons. In the palm it is invaginated on its radial side by the flexor tendons which make it more or less u-shaped. It is in close relation to the middle palmar space. In the wrist the ulnar bursa lies close to the radial bursa.

4. It is interesting to note that although the lumbrical muscles have no synovial sheaths there is a definite fascial canal through which each passes to its insertion on the radial side of the base of the first phalanx of the second to fifth digits. These are of considerable importance and will subsequently be referred to as the lumbrical canals.

B.—On the dorsum of the hand.

There are six or more distinct tendon sheaths enclosing the tendons on the dorsum of the hand. These sheaths begin just proximal to the posterior annular ligament of the wrist, pass under the ligament and extend distally for a distance of about five or six cm. They are arranged as follows:

I. abductor pollicis and extensor brevis pollicis. These may have separate sheaths.

II. extensor carpi radialis longior and brevior.

III. extensor longus pollicis.

IV. extensor communis digitorum.

V. extensor minimi digiti.

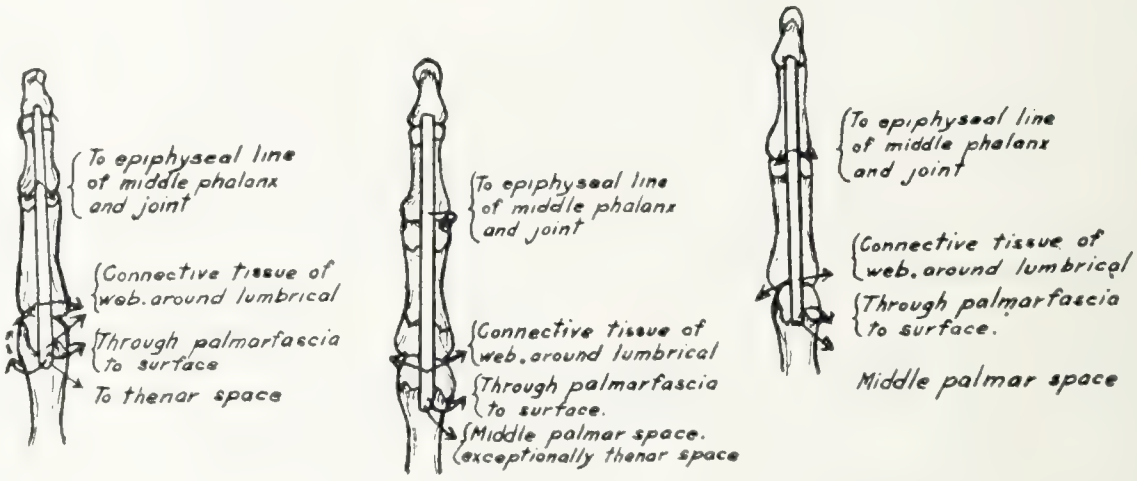
VI. extensor carpi ulnaris.

III. Fascial Spaces

1. The dorsal subcutaneous space is an extensive area of loose connective tissue lying between the skin of the dorsum of the hand and the extensor tendons. It is without definite boundaries and extends over the dorsum of the phalanges.

2. The dorsal subaponeurotic space lies between the extensor tendons and the dorsal interosseous membrane. It is limited laterally by the tendons of the index and little fingers, has a broad base at the knuckles and narrow part at the distal border of the posterior annular ligament of the wrist. These boundaries give it the shape of a truncated cone.

3. The middle palmar space is enclosed by a definite membrane and lies deep in the palm on the volar interossii, with the flexor tendons superficial to it. The space extends radialward to the centre of the middle metacarpal bone where it is in close relation to the thenar space and is overlapped on its ulnar side by the ulnar bursa. It passes distally almost to the heads of the metacarpal bones and proximally just under the distal border of the anterior annular ligament at the wrist.


To epiphyseal line of middle phalanx and joint
Connective tissue of web. around lumbrical
Through palmarfascia to surface
To thenar space
To epiphyseal line of middle phalanx and joint
Connective tissue of web. around lumbrical
Through palmarfascia to surface.
Middle palmar space. exceptionally thenar space
To epiphyseal line of middle phalanx and joint
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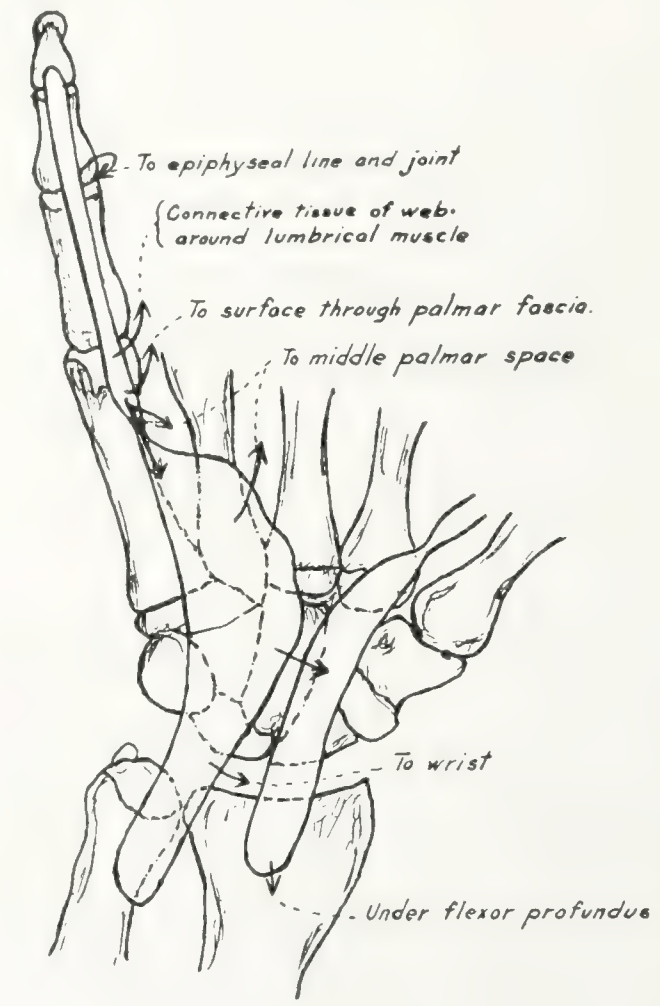
Through palmarfascia to surface.
Middle palmar space

INDEX FINGER MIDDLE FINGER RING FINGER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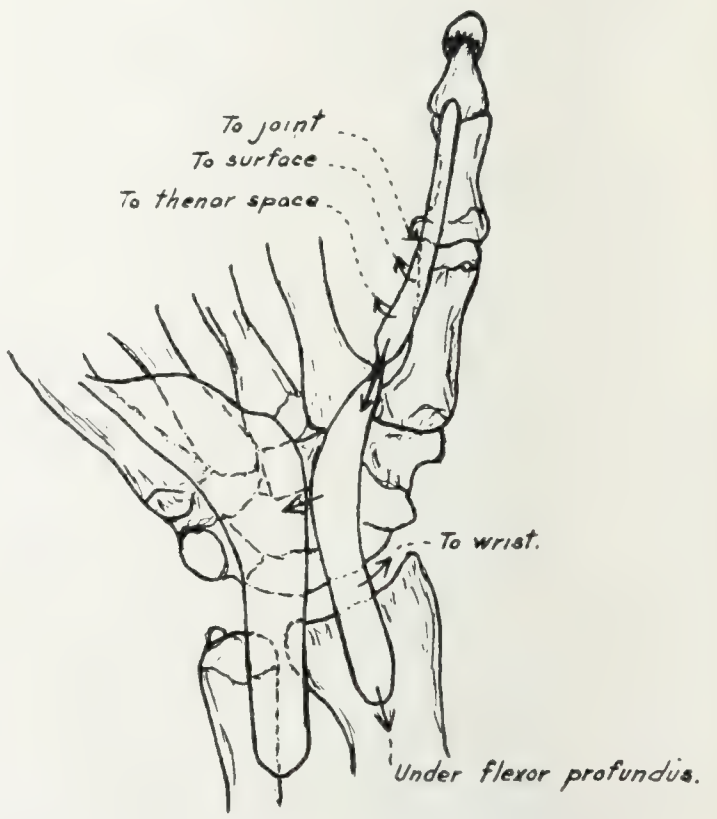
Connective tissue of web. around lumbrical muscle
To surface through palmar fascia.
To middle palmar space
To wrist
Under flexor profundus



Kanavel

PROBABLE EXTENSION OF INFECTION FROM TENDON SHEATHS

4. The thenar space occupies approximately the area of the thenar eminence, its internal border being indicated on the surface by the adductor crease of the thumb. It lies deep in the palm on the adductor pollicis muscle, entirely to the radial side of the middle metacarpal and extends distally to the distal border of the adductor transversus pollicis muscle and proximally for a short distance into the wrist.

5. The hypothenar space is distinctly localized and does not communicate with any of the other spaces nor is it in close relation to any tendon sheath.

6. The lumbrical canals are ill-defined fascial spaces about the lumbrical muscles. They are in close relation proximally to the middle palmar and thenar spaces and distally to the loose connective tissue at the web through which they communicate with the dorsum of the hand.

Pathology

A.—Aetiology

I. Lymphatic

The usual mode of infection is by lymphatic extension from a palmar wound which may be quite insignificant. The common organism is the streptococcus and it is often found in pure culture. The general health and resistance of the patient is usually low.

II. Direct Implantation

This is effected by deep lacerating wounds on the palm, often puncturing the tendon sheaths. This type usually produces a mixed infection of staphylococci and streptococci and may occur in a robust individual.

III. Haematogenous

Infection by the blood is rare and usually gonococcal.

B.—Extension

The possible routes of extension are shown in plate.

Diagnosis

The diagnosis of acute suppurative tenosynovitis is based on the following points:

1. There may or may not be a history of injury.
2. There is considerable systemic involvement due to the presence of pus in a closed space, *e.g.*, headache, chill, rise in temperature to around 103°F., rapid pulse, restlessness, sleeplessness, wandering eyes, etc.
3. The finger involved is symmetrically enlarged.
4. The adjacent fingers are swollen.
5. The dorsum of the hand is oedematous.
6. All the fingers of the hand are slightly flexed.
7. The spontaneous pain is at first severe but disappears with the increasing oedema.
8. There is exquisite tenderness on pressure over the course of and limited to the tendon sheath.
9. There is intense pain on extending the finger involved. This pain is most marked at the proximal end.

Of these, the last two points are of prime importance and the deciding points in the diagnosis.

This condition must be differentiated from (1) Lymphatic infection which shows a lack of extreme tenderness along the tendon sheath and only slight pain on extending the finger. There is also a generalized

oedema of the hand and arm in contradistinction to the localized early swelling of tenosynovitis. (2) Arthritis develops apparently spontaneously, without history of trauma.

Extension of infection is diagnosed by increased swelling and the appearance of exquisite tenderness in the palm or in other tendon sheaths. Extension to the thenar space is evidenced by a ballooning out of the thenar eminence along with slight flexion and marked abduction of the thumb. Extension into the middle palmar space is recognized first by a fullness between the heads of the metacarpals. This becomes evident later than in the thenar space extension because of the dense palmar aponeurosis and results in delayed diagnosis, thus increasing the liability of extension into the thenar space and forearm.

Treatment

A. While the diagnosis is in doubt hot boracic compresses are indicated.

B. When diagnosed, and early diagnosis is the only hope for good functional recovery, drainage is effected by wide incision into the tendon sheath. The patient should be anaesthetised with a general anaesthetic. In order to obtain a bloodless field, a broad tourniquet is applied to the arm and is kept on until the operation is completed and a bandage is applied firmly about the wound.

Incision is made through the skin, on the side of the finger at the level of the flexor surface of the phalanx. The tendon sheath is opened along the shaft of the middle and proximal phalanges and carried three-fourths of an inch into the palm. This usually effects good drainage and avoids prolapse of the tendon from its sheath. If, however, drainage is not good the sheath is opened along its entire length. It is better to err on the side of radicalism than be too conservative.

The third, fourth and fifth fingers are perhaps better incised on the radial side as this facilitates matters should there be an extension into the lumbrical canal.

The second finger is better incised on the ulnar side in order to avoid a scar on the pressure bearing surface.

The thumb is incised on the ulnar side following down the canal, guided by a grooved director and stopping one inch short of the distal border of the anterior annular ligament, so as to preserve the branches of the median nerve which supply the thenar muscles.

The ulnar bursa is opened on the ulnar side in a similar manner, going as far as the distal border of the anterior annular ligament. If infection spreads under this ligament, proximally, into the forearm, it will lie deep to the flexor profundus, first following along the course of the median nerve and then passing over to the ulnar side where it comes to the surface. Pus rarely becomes superficial along the radial artery. Drainage in this region is effectively instituted by an incision which starts from a point on the ulnar side of the forearm on a level with the flexor surface of the bone about two inches above the styloid process and extends three to four inches proximally. Through this incision the finger is inserted and the ulnar bursa ruptured. If more efficient drainage is needed forceps may be passed into this wound, over the flexor surface of the ulna across to the radial side and then cut down upon from that side, making a

wide incision. It is sometimes felt necessary to open this space from the anterior surface to the ulnar side of the flexor carpi radialis tendon and by blunt dissection close to this tendon, pass through the underlying structures and into the deep space, in this way avoiding the median nerve. This incision is usually reserved for opening subcutaneous accumulations of pus.

The middle palmar space, when involved, is drained by an incision between the middle and ring fingers extending one inch into the palm. Through this opening closed forceps are passed into the palm, deep to the flexor tendons. The forceps are then opened and withdrawn.

The thenar space is drained through an incision on the radial side of the index metacarpal, at its middle and on a level with its volar surface. It is opened by passing forceps in as above, but taking care that the tip of the forceps does not reach the middle metacarpal for fear of puncturing and spreading infection into the middle palmar space.

C. Post-operative Treatment

If there is any bleeding it may be necessary to plug the wound with gauze for a few hours, otherwise drainage is effected by strips of rubber or of gauze impregnated with vaseline. Hot, moist dressings applied for twenty-four hours relieve pain and tend to promote walling off of the infection. After this dry dressings are used and the wound is exposed to electric light for a considerable time each day. In the virulent types of infection it is well to avoid manipulation and to immobilize the arm in a slightly elevated position. The use of Bier's constriction is sometimes recommended. Active and passive movements are begun as soon as all danger of systemic infection is over (48 hours). Movement helps in the prevention of firm adhesions and is best conducted in a hot bath, which relieves the pain and aids in cleansing the wound.

Infection of the tendons on the dorsum of the hand is rare and the diagnosis is not difficult. Splitting the sheath throughout its length is the most satisfactory method of treatment.

This brief review is based on the book, "Infections of the Hand", by A. B. Kanavel, M.D., and recent clinical discussion.

CHOLECYSTOGRAPHY

THE newest use of the X-ray in diagnosis is the visualization of the the gall bladder by means of the injection into the blood of a salt, opaque to X-ray, and excreted by the liver. The sodium salt of tetrabrom-phenolphthalein is used, and radiographs of the gall bladder area are taken four, eight, twenty-four and thirty-six hours after the injection.

In ten cases operated on after investigation by this method, seven were found pathological both at operation and by X-ray, and only one of these gave any X-ray evidence of pathological conditions by the ordinary methods. Two cases were normal at operation, and had been shown normal by X-ray. In the remaining case a pathological gall bladder was deduced by this method, but at operation no disease was found, a slight adhesion in the region of the neck of the gall bladder being the only abnormality present.

This method of examining the gall bladder by X-ray thus seems to have definite diagnostic value. B.M.J., Feb. 28, 1925.

CHEMISTRY IN MEDICINE

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A student entering a professional school sees his path and goal ahead much more clearly than does the average student in Arts. Particularly is this true of the medical student. Certainly few would embark on such a long, arduous and relatively costly course as medicine unless they felt within them rather strongly the urge to do what they could to alleviate the sufferings of mankind.

The possession of a definite aim in life is a good thing for the medical student as for anyone else. It gives him fixedness of purpose and provides the strong incentive necessary to keep him cheerfully working away on a time-table calling for thirty-five hours a week of lectures, laboratory and clinical work.

To the young enthusiast for medicine a glance at the content of the course of study of the first and second years is rather disconcerting. There is none of the clinical work for which he yearns. A rabbit seems a relative so far removed that a knowledge of its anatomy, judged externally at least, is but a poor preparation for the practice of surgery. As for chemistry and physics,—Chemist is surely a synonym for Druggist, and a Physicist has nothing to do with physic.

Yet the student need only wander about the hospitals and medical laboratories to see that chemistry and physics are not quite foreign to the study of medicine. He will find potentiometers, and various electrical measuring instruments, X-ray tubes, and sources of ultraviolet light as well as all sorts of chemical operations in progress.

It seems well to point out to the beginner, who is unfamiliar with the history of medicine, a few examples of the importance of chemical research to medical science.

Medicine and chemistry have been closely linked from the earliest times and each has owed much to the other. In the early alchemical period, up to about 1500 A.D., chemistry was largely concerned with the search for the Philosopher's Stone and seems to have had little relationship with therapeutic medicine, though it appears to have been more closely associated with toxicology. Poisons, and antidotes for poisons, appear to have exerted a great fascination on the human mind from the earliest times.

From 1500-1700 A.D., a school of chemists, the Iatro-Chemists, the best known of whom are Paracelsus and Libavius, directed their efforts to the cure of ills by drugs. Paracelsus is often called the founder of chemical pharmacology and therapeutics.

The years following 1775 are the quantitative period in chemical science, when chemistry and physics advanced hand in hand to the position they now hold as exact sciences. May we mention a few of the chemists of this period, whose work seems to be of outstanding interest to medical men.

Liebig is considered as the founder of agricultural chemistry and one of the founders of physiological chemistry. He discovered hippuric acid, chloroform and many other compounds, and did an immense amount of work on the chemistry of urea, the bile, the blood, and the fats. Liebig's work was the foundation of the chemistry of the proteins and of metabolism.

Pasteur's official qualifications were those of chemist. He was professor of chemistry at Strassburg, and later at Lille, and the Sorbonne. Yet certainly Pasteur was much more than chemist, and can only be defined as philosopher. He demonstrated conclusively the germ theory and showed that the theory of spontaneous generation was untenable. The work of Pasteur led to Lord Lister's study of wound infection and resulted in the birth of antiseptic surgery.

The name of Emil Fischer, professor of chemistry at Berlin, will always be associated with his attempts at the synthesis of proteins from their amino acid constituents. Equally important, perhaps, was his discovery of phenylhydrazine and its use in the investigation and synthesis of a host of new sugars. All this work led to a more precise knowledge of carbohydrate metabolism and of diabetes. He also synthesized veronal and many other drugs. Ehrlich, another great chemist, is perhaps most famous for his work on dyes and tissue staining. He enunciated a theory of immunity which led to the discovery of the Wassermann test. He discovered Salvarsan and other arseno-benzol derivatives, which have been of much value in the treatment of syphilis.

Modern medicine is an applied science. The medical world stands ready to use every new discovery in physics, chemistry, or any other science. Irving discovers a test for bilirubin; Van den Bergh modifies this test so as to estimate the bilirubin in the serum from a small quantity of blood. At once very valuable work on liver disease and jaundice follows. Microchemical methods are being developed for the determination of non-protein nitrogen, urea, creatinin and other substances present in small amount in the blood. Medicine needs all these tests very badly and as soon as they are published they are put to practical use at once.

Fifty years ago the relation of bacteria to disease was discovered and in the impetus derived from the application of the study of bacteriology to medicine, chemistry was largely overshadowed.

There has been recently a distinct revival of the study of biochemistry, and an intense interest is being shown by medical men in the chemistry of digestion and the processes of metabolism and excretion.

What an immense field lies ahead! The vitamins play a very important part in nutrition, and though their action is to some extent known as well as methods of extracting and concentrating them, none of them have been isolated and their composition, is of course, unknown.

The chemical aspects of immunity are little understood. The tests for toxins and antitoxins are almost all biological and almost nothing of their chemical nature is known.

The fascinating problem of the internal secretions lies before us. Much of the cellular contents are colloidal in their nature and a knowledge of the fundamentals of colloidal chemistry, gained perhaps by

the study of simpler colloids, is necessary before attacking the very complex systems found in the body.

If the medical student wishes to make the most of his six years at college, and especially if he hopes, after he has taken up practice, to follow intelligently the advances in his science, he must be prepared to read a good deal of biochemistry. His first and present task is, of course, to become familiar with the elementary principles of general chemistry. He should not be over impatient at a year or two spent in the study of the fundamental sciences. Specialization comes very soon and tends to cramp one in when it does come. A telescope reveals much that is hidden to the unaided eye, but when pointed always in the one direction, its angle of vision is very narrow. One must acquire some breadth of view to be a true philosopher,—as defined in an old edition of Ogilvie's Imperial Dictionary, "The objects of philosophy are to ascertain facts or truth, and the causes of things or their phenomena; to enlarge our views of God and his works and to render our knowledge of both practically useful and subservient to human happiness."

ULTRA-VIOLET THERAPY

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On being requested to write an article on helio-therapy, it seemed understood that this would explain the use of the quartz-mercury lamps. Helio-therapy means cure by the sun and includes no other form of treatment than that of the sun itself whether direct or filtered. The use of ultra-violet light as produced by the quartz-mercury or tungsten lamps is termed actino-therapy. The actinic ray is the same as the ultra-violet; "it is called actinic because it has the power to excite chemic action and ultra-violet because it lies just beyond the violet of the visible spectrum" (Sampson).

In the spectrum, visible light ranges from 4000A° wave-lengths to somewhere near 90,000A°. Above this lies the infra-red and further the invisible heat waves. Below 4000A° comes the invisible ultra-violet ranging down to 360A°. The wave-length of the extremely short X-ray is from 10A° to less than one, leaving an uncharted field between ultra-violet and X-ray. Thus it may be seen that the ultra-violet has a very long range and so has been divided for technical reasons into three groups: near, far and extreme ultra-violet. The far, or shorter wave-lengths, have penetrating powers, but not beyond two millimeters of thickness of blood. It seems a flat contradiction, then, to say that ultra-violet can fog a sensitized plate through the body, but that has been done. Sampson uses this fact to prove that the light is carried by the blood, since he was able to fog a plate under the left calf when throwing ultra-violet light on the right shoulder.

There is definite proof that the actinic ray is bactericidal. Experiments with living bacteria show that cocci were more readily destroyed than bacilli or fungi, and that this could be accomplished only with great difficulty if the rays had to pass through water and not at all through glass. Only the shortest rays are absorbed by protoplasm.

Edgar Mayer says that the action of light on ferments and so-called anti-bodies is mostly a matter of speculation. He adds, however, that "the more important ultra-violet rays that affect cells, toxins, ferments, etc., are present in the quartz-mercury light, but absent in the sunlight as it reaches us." The ultra-violet ray does definitely produce a leucocytosis.

The actinic ray is produced by the so-called quartz-mercury lamps. The anode is a well of mercury and the cathode a platinum wire. Since glass is not permeable by any but the very longest wave-lengths, the tube is of quartz—a material permeable to ultra-violet down to 1849A°. Fluorspar allows even a longer range, but is impracticable. There are two kinds of lamps, one for large areas, cooled by air and one with a small lens, cooled by water and used for purely local treatments. The air cooled is in more general use than the local, though the latter is remarkably efficient in the fewer cases where it is used. Ultra-violet is invisible; the green light apparent is from the small percentage of longer wave-lengths that are unavoidably present. The feeling of warmth when the lamp has been burning for some time is similarly explained.

The use of these lamps is varied. They are not cure-alls, but certain conditions respond well. Tuberculosis, particularly surgical cases, show excellent results. According to both de Grasso and Mayer, surgical tuberculosis responds very much more than pulmonary. Many dermatological afflictions clear up most successfully, such as psoriasis and acne. In the healing of high frequency or X-ray burns the actinic ray is evidently successful. Sampson claims that the use of ultra-violet previous to X-ray causes a marked tolerance to X-ray. In treating neuritis combination of X-ray and ultra-violet achieves excellent results. The ray has an undisputed part in the treatment of rickets and, recently, experiments at Yale have discovered ultra-violet radiations in cod liver oil, one of the essentials in treating rickets, thus opening a new field.

Ultra-violet light still holds unexplored qualities, but there is no doubt whatever of its value as a therapeutic agent. Experiments are being constantly carried on and definite facts and rules established, but the extent of the field has not been clearly ascertained. Too much has been claimed for it, which has prevented many physicians from accepting it. This is being continually remedied, and no one who believes in and uses physio-therapy can ignore the value of the quartz-mercury lamp. It has established, by a long chain of results, a definite place in therapeutics.

MARK TWAIN SAID

"Man can't sleep out-of-doors without freezing to death or getting the rheumatism; he can't keep his nose under water over a minute without being drowned. He's the poorest, clumsiest excuse of all the creatures that inhabit the earth.

"He has to be coddled, housed, and swathed and bandaged to be able to live at all. He is a rickety sort of thing any way you take him—a regular British Museum of infirmities and inferiorities.

"He is always undergoing repairs. A machine as unreliable as he is would have no market.

"The higher animals get their teeth without pain or inconvenience.

Man's come through months of cruel torture, at a time when he is least able to bear it. As soon as he gets them they must be pulled out again. The second set will answer for a while, but he will never get a set that can be depended on till the dentist makes one.

"Man starts in as a child and lives on diseases to the end, as a regular diet. He has mumps, measles, scarlet fever, whooping cough, croup, tonsilitis, diphtheria, as a matter of course.

"Afterward, as he goes along, his life continues to be threatened at every turn by colds, coughs, asthma, bronchitis, quinsy, consumption, yellow fever, blindness, influenza, carbuncles, pneumonia, softening of the brain, and a thousand other maladies of one sort and another.

"He's just a basketful of pestilent corruption, provided for the support and entertainment of microbes. Look at the workmanship of him in some particulars.

"What is his appendix for? It has no value. Its sole interest is to lie and wait for stray grape seeds and breed trouble.

"What is his beard for? It is just a nuisance. All nations persecute it with the razor. Nature, however, always keeps him supplied with it, instead of putting it on his head.

"A man wants to keep his hair. It is a graceful ornament, a comfort, the best protection against weather, and he prizes it above emeralds and rubies, and half the time Nature puts it on so it won't stay.

"Man isn't even handsome, as compared with the birds, and as for style, look at the Bengal tiger—that ideal of grace, physical perfection and majesty.

"Think of the lion and the tiger and the leopard, then think of man—that poor thing! The animal of the wig, the ear-trumpet, the glass eye, the porcelain teeth, the wooden leg, the silver windpipe—a creature that is mended all over from top to bottom.

"If he can't get renewals of his bric-a-brac in the next world what will he look like?"

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